SCIENTIFIC AMERICAN

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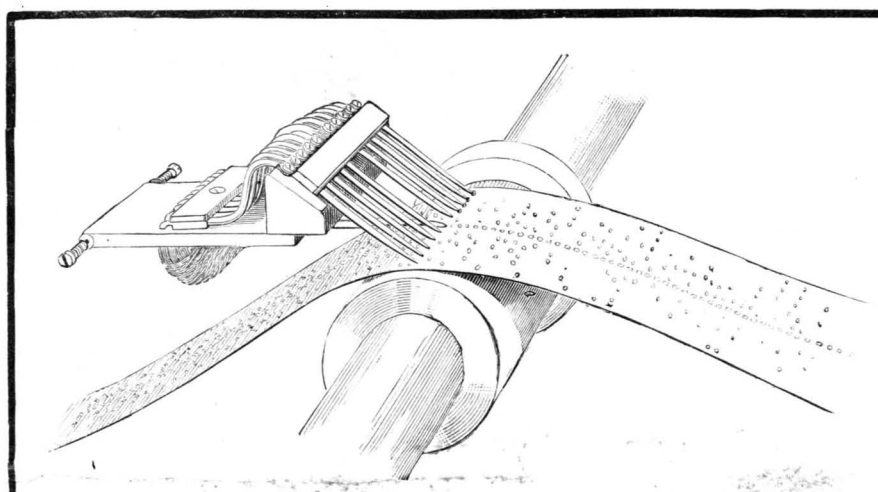

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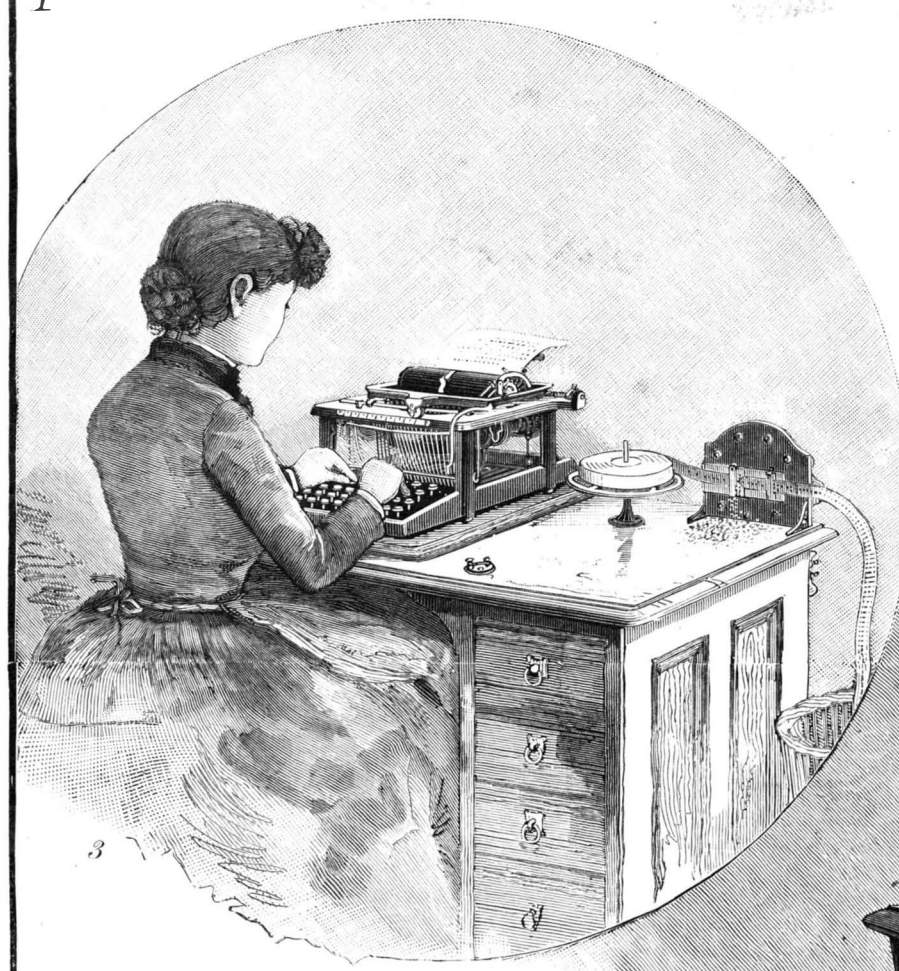

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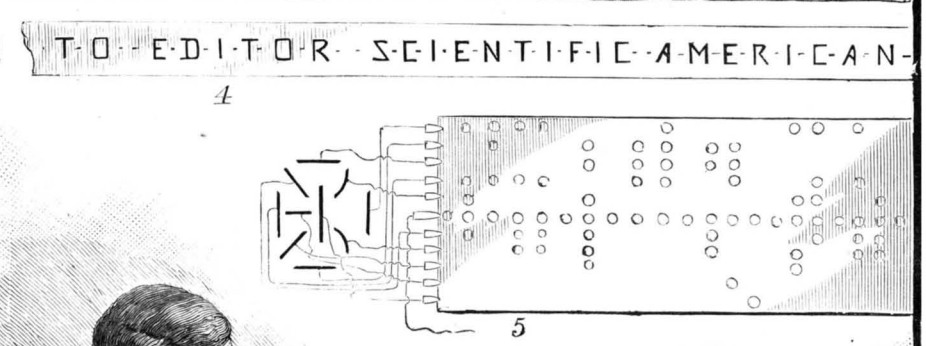

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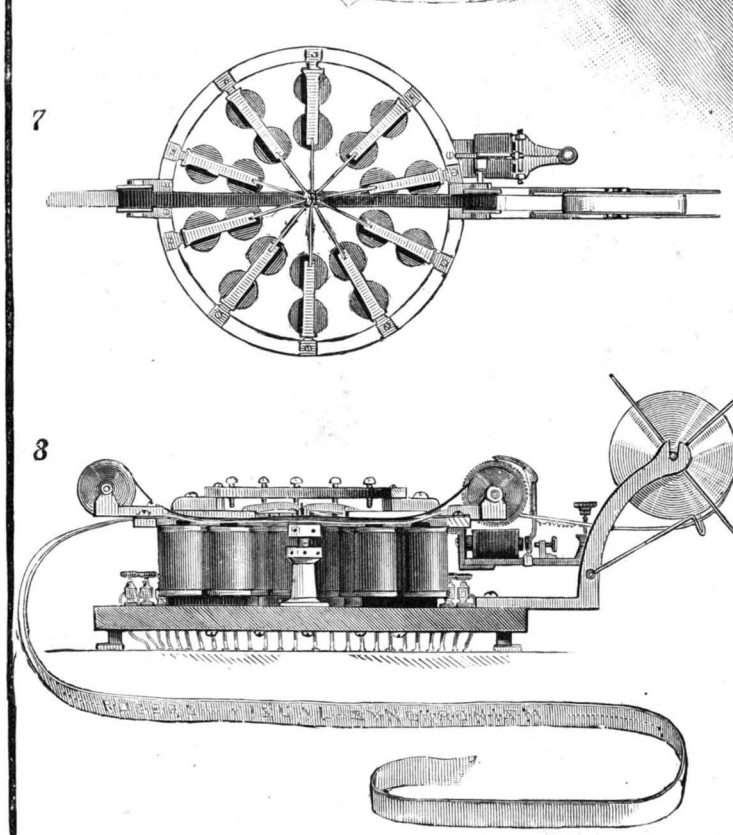

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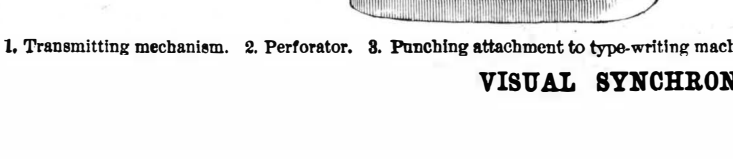

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VISUAL SYNCHRONISM IN RAPID TELEGRAPHY.—[See page 405.]

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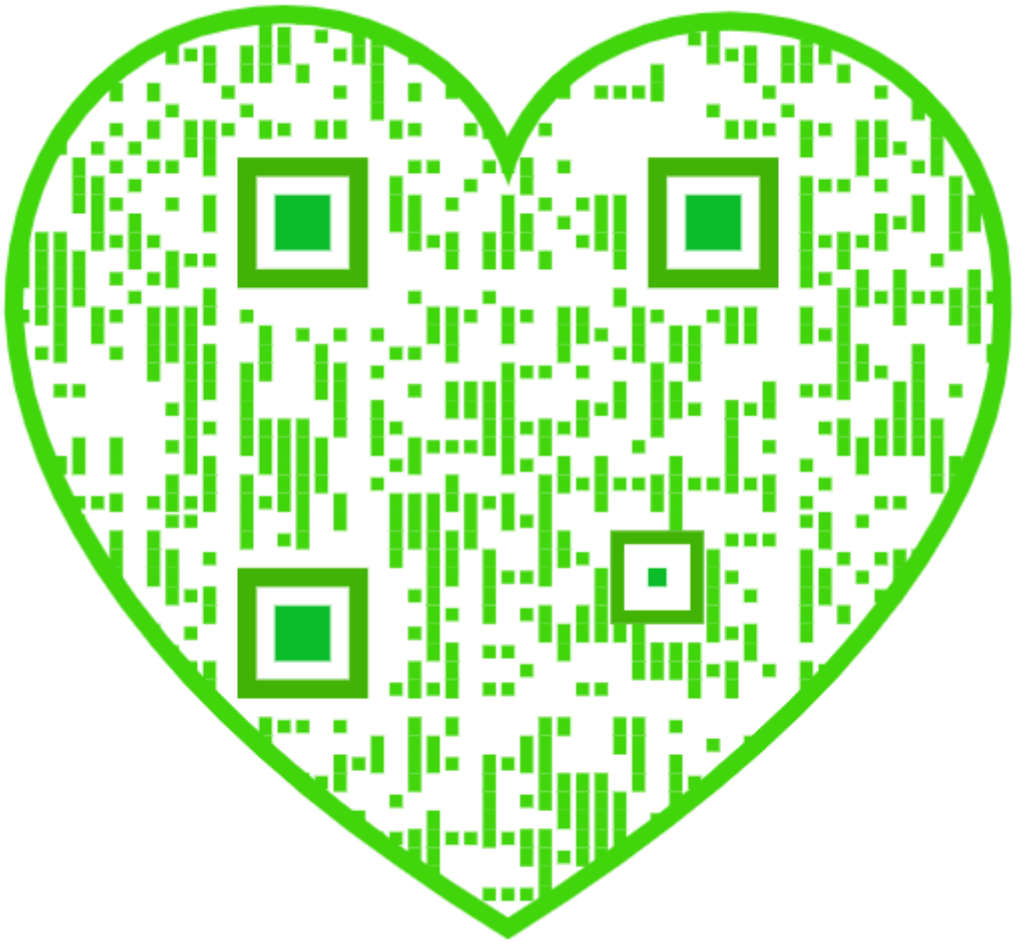

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NEW YORK, SATURDAY, DECEMBER 28, 1889.

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THE ELECTRIC-LIGHT TROUBLES IN NEW YORK.

The business of renting arc lights in New York city, save in isolated plants, has been almost wholly given up for the present; the companies discharging the men connected with their distributing service and preparing to devote themselves to making and selling plant.

The indiscriminate cutting of arc light wires has destroyed many thousands of dollars worth of property and rendered still more costly plant and construction comparatively valueless, and though it has long been clear that energetic measures were required on the part of the authorities, because of the danger to life as well as property made imminent by the constant appearance of vagrant currents of high tensions along low tension and often bare wires, it is to be regretted that what in all probability were the chief aggressors, to wit, the telegraph companies, including burglar, time, messenger, and similar services, have been left undisturbed.

Looking back upon the immediate causes of that public inquietude which led up to the adoption of the present measures, we shall find that, save where the victim's foolhardiness brought about his fate, the arc light system was only indirectly the cause of the accidents. It is an undisputed fact that the telegraph companies do not remove their dead wires, probably because of the expense and trouble. There are hundreds, doubtless thousands, of these, and, as every observer is aware, these are constantly parting. You can look out of the back window of almost any house and discover broken wires of one kind or another swaying to and fro, and such a sight is not by any means infrequent in the streets, especially in the side streets. Now, a dead wire, if broken and yet not hanging down far enough to interfere with the roadway or sidewalk, may remain for an indefinite period, swaying about. Its condition will not be noticed at the central office, because it is not in use.

Such wires, there is reason to believe, have been circuiting the arc currents, swaying hither and thither, and charging now this wire, now that, with the terrible intensity. The best part of the evidence yet adduced points that way. The experience with arc light currents in other cities where the telegraph lines are kept under careful inspection, and no such casualties have come, helps to the conclusion.

Besides this the light companies have had to contend against the constant interference of a board of electrical control, which, in the language of the Grand Jury, "is incompetent." Inspectors, for the most part incompetent, as might be expected of appointees of a political board, were found to be slighting their duties, the circuits were not "tested every hour," as the law provides, and even if they had been it would not have been sufficient under the circumstances, because a "ground" might take place a few moments after inspection.

POSITION OF THE PLANETS FOR JANUARY.

MERCURY

is evening star until the 30th, and after that time becomes morning star. He reaches his greatest elongation eastward from the sun on the 13th, at 8 h. P. M., being 18° 51′ east. He is then, and for a few days before and after, in favorable position for observation with the naked eye. He sets on the 13th, an hour and three-quarters later than the sun, and may be found in the west, about 4° north of the sunset point, becoming visible about three-quarters of an hour after sunset. Mercury is in inferior conjunction with the sun on the 30th, at 0 h. 42 m. A. M., passing between the earth and sun, like the moon at new moon.

Mercury sets on the 1st at 5 h. 31 m. P. M. On the 31st he rises at 6 h. 34 m. A. M. His diameter on the 1st is 5″.6, and he is in the constellation Sagittarius.

SATURN

is morning star. He has advanced so far toward opposition that he is very favorably situated for observers during the whole month. Star gazers, who are familiar with the Sickle, will easily find the planet about 4° east of Regulus, the bright star in the handle, rising at 8 o'clock in the middle of the mouth.

Saturn rises on the 1st at 8 h. 52 m. P. M. On the 31st he rises at 6 h. 44 m. P. M. His diameter on the 1st is 18″.2, and he is in the constellation Leo.

JUPITER

is evening star until the 10th, and morning star for the rest of the month. He is in conjunction with the sun on the 10th, at 0 h. 47 m. A. M., and passes to the sun's western side, to take his place among the morning stars. He meets Venus as he makes his way westward from the sun. The two planets are in conjunction on the 19th, at 4 h. 20 m. A. M., Jupiter being 27′ north. They are, however, too near the sun to be visible, and at the time of conjunction are below the horizon.

Jupiter sets on the 1st at 5 h. 4 m. P. M. On the 31st, he rises at 6 h. 17 m. A. M. His diameter on the 1st is 30″.6, and he is in the constellation Sagittarius.

VENUS

is morning star. She is of little account during the month on account of her great distance from the earth and her near approach to the sun.

Venus rises on the 1st at 6 h. 38 m. A. M. On the 31st, she rises at 7 h. 3 m. A. M. Her diameter on the 1st is 10″.2, and she is in the constellation Sagittarius.

URANUS

is morning star. He is in quadrature with the sun on the 16th, at 2 h. P. M., and is then 90° west of the sun. Uranus rises on the 1st at 1 h. 21 m. A. M. On the 31st he rises at 11 h. 24 m. P. M. His diameter on the 1st is 3″.6, and he is in the constellation Virgo.

MARS

is morning star. He is near enough to the earth to be readily recognized, a red star east of Spica, rising about 1 o'clock on the middle of month.

Mars rises on the 1st at 1 h. 42 m. A. M. On the 31st, he rises at 1 h. 5 m. A. M. His diameter on the 1st is 6″., and he is in the constellation Virgo.

NEPTUNE

is evening star. He sets on the 1st at 4 h. 21 m. A. M. On the 31st he sets at 2 h. 21 m. A. M. His diameter on the 1st is 2″.6, and he is in the constellation Taurus.

Venus, Mercury, Jupiter, Mars, Uranus, and Saturn are morning stars at the close of the month. Neptune is evening star.

Smokeless Powder.

According to the reports of Lieut. Crozier, who has made special observations in Europe concerning the practical values of the smokeless powders, there are difficulties that interfere with their common adoption, namely: The irregularity of pressure, the quickness with which they deteriorate, and the intense heat, which burns the shell and affects the accuracy of fire.

France, Germany, and Switzerland have issued the new powder for general use, but the discovery is still in an experimental stage. Switzerland is the only country that has adopted and adhered to a definite standard of smokeless powder for any length of time. With the new Swiss Reubin-Schmidt regulation rifle the highest velocity obtained with a charge of the new standard powder adopted by this country was 1,970 feet per second, the bullet used weighing 216 grains and the powder charge thirty-one grains. The pressure, however, was dangerously great—37,000 pounds to the square inch being recorded.

Rather better results were obtained by the French with the new Lebel rifle, an initial velocity of 2,020 feet per second and 34,800 pounds pressure being recorded, the weight of the charge of smokeless powder being 43¼ grains and that of the bullet 232 grains. These are about the best results ever given with a small arm. The highest velocity with our Springfield rifle is 1,350 feet per second.

Language Instruction by Phonograph.

Edison's phonograph has scarcely, as yet, passed the period of "novelty and curiosity," but many practical applications of the instrument have already been suggested, and have in some cases been actually carried out. There is one application, however, that we have so far not heard mentioned, and that is the instruction in the pronunciation of foreign languages. It is impossible to learn to speak a foreign modern language by self-instruction, since the true pronunciation can only be acquired by personal intercourse with one who is a native or equal to one in linguistic perfection. In the future the publishers of manuals of instruction in foreign languages will find it, most likely, a paying undertaking to publish a phonographic key of the various exercises, thus enabling the learner to acquire the correct intonation and pronunciation by causing the phonograph to repeat the word or sentence until it has been perfectly imitated by himself. Perhaps this suggestion may be thought to be foreign to the purposes of a pharmaceutical journal. But our profession is so situated, in many parts of the country, that a knowledge of more than one language is almost a necessity. And while actual instruction by a competent teacher is certainly the best method, the substitution of the phonographic method appears to us to be the next best in choice. We can only throw out the suggestion here, and must leave the practical execution to those who control the phonograph.—*Amer. Druggist.*

The Albany Water Supply.

The determined and costly attempt which was made at Albany to obtain an adequate supply of water from driven wells appears to have failed. The contractors guaranteed a supply of 15,000,000 gallons a day, but as yet from 390 driven wells a supply of but about 6,000,000 gallons a day has been obtained. Professor Mason of the Rensselear Polytechnic Institute, of Troy, in speaking of the subject recently, stated that Albany needed a supply of 20,000,000 gallons of water daily, and at the rate at which the wells are now yielding, it would require about 1,200 wells to furnish this quantity. Professor Mason believes the Hudson River to be the only adequate source of supply upon which the city can depend, but says that the river water should be thoroughly purified, and favors the adoption of a complete modern filter plant for this purpose. —*Fire and Water.*

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The Pratt Institute.

We have from time to time chronicled the progress of the Pratt Institute in Brooklyn, N. Y. Although this institution cannot boast of a long existence, this has certainly been more than compensated for by an unprecedented growth and development, and by the modern, and in some respects unique, plan upon which it is organized. The rapid growth of the institution is obviously due to two causes; first, the demand for just such a school, and, second, the munificence which keeps pace with that demand.

From a perusal of the first number of the very creditable journal, *The Pratt Institute Record*, we learn that during the year several new departments have been created, among which are wood carving, clay modeling, and vocal music. Many volumes have been added to the library, and the shelving capacity has been expanded accordingly. The technical museum has received many new and interesting additions during the year, and the already capacious buildings have been enlarged so as to add 20,000 square feet of floor space.

The founder, in his address to the teachers, scholars and friends of the Institute on founder's day (October 2), mentioned a new feature which is now associated with the institution, and is known as "The Pratt Institute Thrift Association." This association is designed to assist people in general, and young people in particular, in saving and wisely investing their earnings. This association is divided into two parts, one known as the investment branch, and the other as the loan branch. The investments are made by purchasing shares of the association. These may be paid for in instalments or regular payments. They bring a fair rate of interest, and afford the safest and best kind of investment for savings. For example: One dollar per month, with the interest and premium, will in ten years amount to $160.

The loan branch is organized with special reference to aiding in the purchase of dwelling houses by persons for their own occupation, and although the association does not purchase or build houses, its organization is something like that of existing building associations.

Mr. Charles Pratt and his associates have recently made a tour of Europe, visiting all of the principal cities and absorbing ideas which might prove in any way helpful, and while they found nothing exactly like the Pratt Institute, they could see no reason for making changes in the main features of its organization or management.

A Thirty-five Knot Steamer.

The *Engineering and Mining Journal* has seen the drawings for a new steamer intended to make the Atlantic voyage in 4½ days. She is to be 434 ft. long, 2,880 tons displacement, patterned after the French torpedo boats. The new ship is to be capable of making 35 knots an hour for 24 hours, and an average for the above voyage of 28 knots an hour.

We hope the Secretary of the Navy will inquire into this proposed boat, and if it promises to be practical, ask for authority to build one quickly. It would be a great satisfaction to the public if Congress would show spirit enough to sanction the building of even one vessel that could reach the top notch either in speed or fighting strength. So far all the additions to the navy have been ships that are lacking in these qualities as compared with the boats of some other nations.

Epidemic Influenza.

The epidemic of influenza which we have already referred to as occurring in Russia has spread into Finland and eastern Prussia, and is not unlikely to spread throughout Europe, and even reach this country. The disease travels rapidly, and has been known to make all Europe sneeze within six weeks, so that we may expect an arrival here before our winter months are over. It used to be thought that this epidemic moved in definite cycles of one hundred years. Although such an idea has long been abandoned, it is a curious fact that the influenza prevailed in America one hundred years ago, and Dr. John Warren, in a letter to Dr. Lettsom, says that "our beloved President Washington is but now recovering from a severe and dangerous attack of it."

In 1830 an epidemic started in China, it reached Russia in January, 1831, and by May it had spread to western Europe; but it only reached this country in January, 1832, and then prevailed but slightly.

Another and severe epidemic started in Russia in December, 1836; within a month it appeared in London, and rapidly spread over Europe. This time, again, America was not affected. An epidemic of considerable extent prevailed in the United States about ten years ago, and there have been various mild manifestations of the disease. On the whole, however, North America does not seem to be very favorable to the development of epidemic influenza in its worst forms, and it is unlikely that we shall have a severe visitation, if we have any at all.

The disease is not dangerous, except sometimes to children or the aged, while the former often show a decided exemption.

There is no doubt that this new epidemic will prove a boon to bacteriology, for Seifert's micrococcus has not quite satisfied pathologists, and we anxiously await the announcement of the discovery of the influenza bacillus, only regretting for the sake of American science that the miasm always begins in the East and travels West. The bacteriological laboratories of Europe will therefore have the first chance.

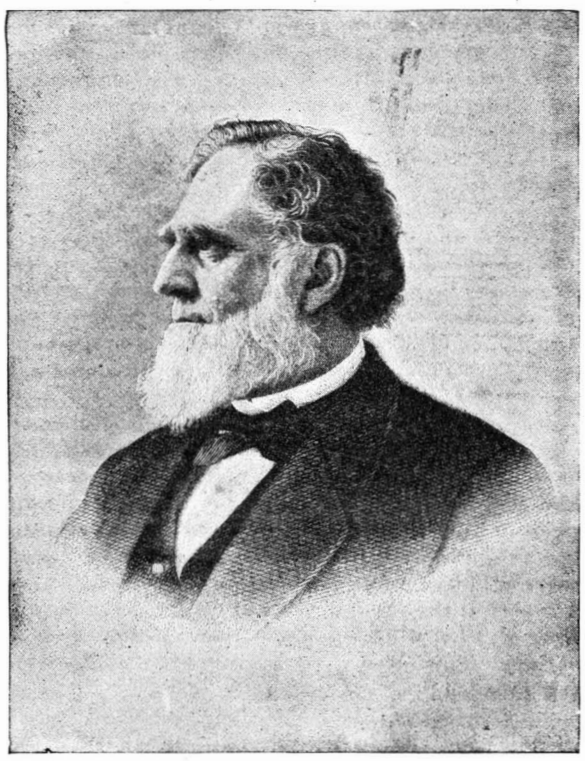
The disease is undoubtedly due to some micro-organism which floats in the air, and which infects the human system, but is generally killed in so doing. For influenza is but slightly if at all contagious.

We observe that some feeling of alarm prevails lest this epidemic be a precursor to cholera, as was the case in 1831 and 1847.

There have been, however, plenty of cholera epidemics without a preceding influenza, and a great many influenza epidemics without any associate cholera. The micro-organisms of the two diseases are as essentially different as are the diseases themselves. The cholera germ lives in water and soil, the influenza germ in the air. The relation between the two diseases has been, we believe, purely accidental.—*Medical Record.*

ELIAS PARKMAN NEEDHAM.

It is with much regret we record the death in this city, on the 28th ult., at the age of 77 years, of this excellent man and distinguished inventor, whose portrait we here present. He was the father of the modern parlor organ industry, and of its later branch, the automatic organ. An extended biographical sketch, containing many interesting facts, is given in the current number of our SUPPLEMENT, to which readers are referred.



ELIAS PARKMAN NEEDHAM.

Notes.

The International Maritime Conference has decided not to recommend the establishment of a permanent international marine tribunal to try questions of collisions between subjects of different nationalities, nor will it recommend the adoption of an international load line, like the English Plimsoll line, beyond which no ship may legally be loaded—a wise precaution, be it said, that has doubtless been the saving of many lives, and, generally speaking, has proved a check upon thoughtless and, perhaps, conscienceless owners and masters.

The Central Park obelisk has long been known to be suffering from the rigors of the climate. The disintegration of the surface has, indeed, increased since the application of a paraffine coating, a treatment that seems to have been recommended inadvisedly, well-informed persons calling it unscientific and inexcusable. Professor Eggleston, of Columbia College, an authority on such subjects, says that, while a coating of paraffine might benefit porous stones, it is exceedingly harmful to granite—the obelisk is of red sienite, a species of granite. It was the heating, he says, that did the mischief. It opened the cracks and emptied them of the fungus growths that had been accumulating there for ages. He declares that the heating given it and the rough handling of the workmen, who ruthlessly chipped this noble stone, prying off every piece that was fissured, effected more harm than its 2,000 and more years of exposure to nature's elements. Continuing, he says: "Most granite has three different planes of dilatation. Heat applied to the surface of this stone in our climate could not fail to set all these disastrously at work. Those who did the [illegible] to have taken from the obelisk and carried off 800 pounds of its substance, and the probability is that the amount was twice as great. In its present condition and place I don't believe the monolith, as such, will last more than 60 or 70 years."

A dispatch from St. Petersburg says that a new rifle has been adopted for use in the Russian army. It can be used as a single firer or as a magazine gun, the soldier being required to carry two different kinds of cartridges. Russia has steadfastly refused to adopt a magazine gun heretofore on the ground of its well-known wastefulness, the soldier, as has been proved, being inclined to fire away without taking proper aim when he can do so without reloading, thus relying upon the number of shots rather than to their effectiveness, whereas, with only one shot to fire, he has been found to be more careful of his ammunition. Under all save extraordinary circumstances the new arm will be used as a single firer.

The big find of uranium in Cornwall, in England, and the prospects of a greatly reduced price for that formerly considered rare metal, is likely to lead to its employment as a substitute for gold in many ways. With copper and platinum, alloys are made with it that rival gold in beauty, indeed, where the latter is used with it, it will successfully resist the action of acid.

The height of sea waves has long been the subject of controversy. Eminent hydrographers have insisted that storm waves were usually not more than 10 feet high, and rarely over 20 when the conditions of the sea were most favorable for wave development. Many a traveler, reclining on a cabin transom, has looked up through the skylight to see the waves rearing their frothy crests, and wondered how even a 20 footer could show so high above a great ship's deck. Many a sailor dowsed by an up-driving wave while lying out on a topgallant yard has, doubtless, shaken his head incredulously when told that the highest waves were not above 20 feet, the rest being "heel" of ship and dip of yard. Now, however, comes expert testimony to prove that storm waves are often 40 feet and sometimes from 60 to 70 feet in height. In the recent British scientific expedition some instructive data were gathered by a sensitive aneroid barometer capable of recording its extreme rise and fall by an automatic register. "With a sea not subjected to an atmosphere of unusual violence, it indicated an elevation of 40 feet from the wave's base to crest." Admiral Fitzroy, after a long series of careful measurements from the main top of his ship, came to a similar conclusion.

A recent assertion that water color paintings are affected injuriously by constant proximity to electric lights, the more delicate pigments fading in consequence, does not seem to be borne out by the facts. As a disintegrating force, daylight is known to be far more powerful than electric light of equal intensity. The latter too, as is well known, is a less active agent than daylight to photographic paper.

This is the Last Number of this Year.

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Tying up Branches.

Now is the time to tie together the limbs of those trees, both fruit and ornamental, that have made a long spreading growth, and whose limbs fork out. By tying all the limbs together about a foot up from where they leave the trunk, they are prevented from breaking or splitting down with the snows and ice storms of winter, as well as by [illegible]

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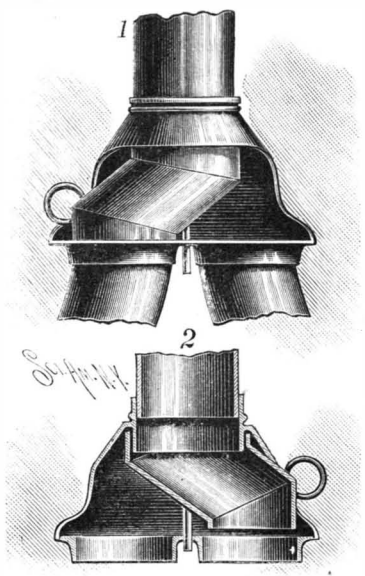
AN IMPROVED RAIN WATER CUT-OFF.

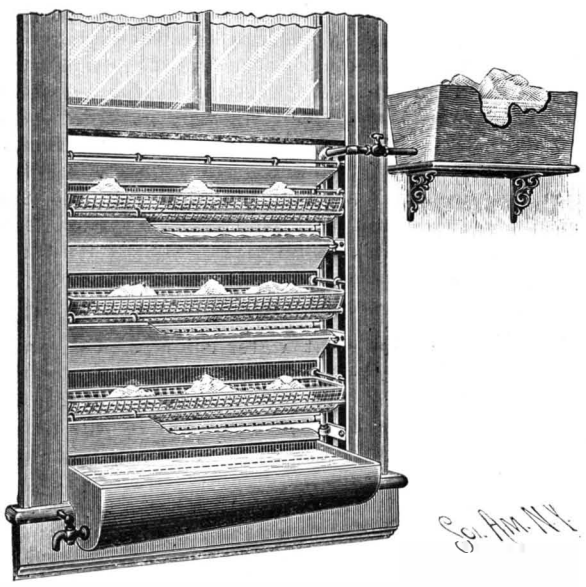
The accompanying illustration represents a simple device which may be readily adjusted to position and manipulated to direct the flow of water from the main leader to a supply or to a waste leader, Fig. 1 being a face view and Fig. 2 a sectional representation. This invention has been patented by Messrs. John M. Baird and Robert Sandstrom, of Topeka, Kansas. The cut-off body is formed with a flange adapted to receive the lower end of the main leader, this flange being carried downward to receive a flange formed at the upper end of a switching tube, the lower end of this tube also having a flange adapted to fit into flanges on the delivery and waste pipes. The switching tube is guided by a central stud or pin riding in bearings in the cut-off body.



BAIRD & SANDSTROM'S RAIN WATER CUT-OFF.

AN IMPROVED AIR COOLING APPARATUS.

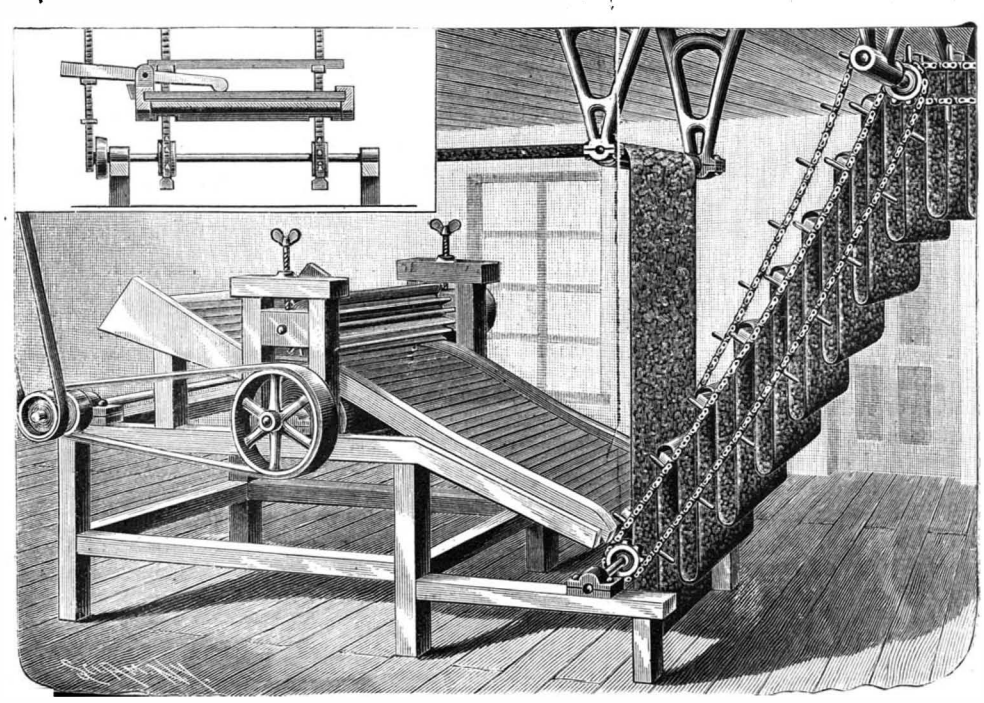
The accompanying illustration represents an apparatus applicable to window or door openings for cooling the air supply, to promote comfort or contribute to the recovery of sick persons. It has been patented by Mr. Leon C. Fouquet, of Andale P. O., Kansas. Frames of light metal rods with cross bars and a filling of wire netting fabric are fastened to opposite sides of a window frame below the raised lower sash, and to these frames are fixed other cross bars from which wire ice baskets are suspended. To the inner side of each basket near its top is attached a rod from which is hung a coarsely woven flannel or woolen fabric. There is also a fabric-supporting rod above the upper ice basket, and the fabrics from all the rods are conducted outward and over deflecting rods, each fabric having at its lower edge a metal rod to hold the fabric down and prevent its being flapped about by the wind. The arrangement is such that the cold drip water from the ice baskets will trickle down over and through the fabrics into a drip tray held over the window sill, and having a laterally inclined bottom, with a faucet at one end for withdrawing the water. The fabrics are designed to spread over the full area of the window opening, thus cooling and tempering the air which enters the room. A water spray or sprinkler pipe is also arranged to be operated over each of the fabrics if desired, these spray pipes being connected with a common supply pipe communicating with a tank in which ice water is held, as shown in the illustration, or with any regular source of water supply, the flow being regulated according to the circumstances. The entire construction is designed to be light and cheap, and such as may be readily fitted to any sized window or door opening, and easily taken down and packed away in small space.



FOUQUET'S AIR COOLING APPARATUS FOR ROOMS.

AN AUTOMATIC PAPER CARRIER FOR DRYING ROOMS.

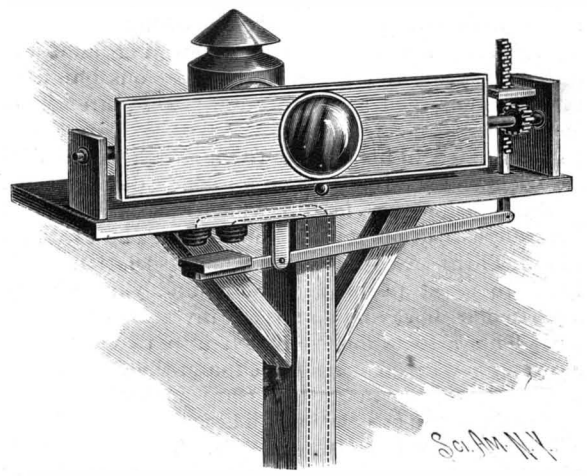
The endless web of paper coming from a press on which wall paper is printed, and from some forms of paper-making machines, is automatically received by carriers adapted to support the web in suspended loops, and move it along gradually, with the surfaces kept separated, for considerable distances, in spacious rooms or drying lofts, whereby the paper is dried preparatory to packing it for market. A machine for automatically feeding to such a carrier the laths on which the paper is looped is represented in the accompanying illustration, and has been patented by Mr. Isaac Dunn, of New Brunswick, N. J. In front of the hopper into which the laths are thrown is a bed roller or cylinder and an upper feed-regulating wheel with radial peripheral blades, so arranged that when both are rotated, the blades or wipers of the wheel will pass but one lath at a time, flatwise, to an inclined lath chute below. The feed-regulating wheel is journaled to be adjustable to accommodate laths of different thicknesses. The lath chute is grooved at its sides to receive opposite ends of the lath, and the lowermost lath is held in the chute by retaining plates extending across the ends of the grooved sides, the floor of the chute being notched to allow of the passage of the fingers or lugs of endless carrier chains, which take the laths one at a time from the chute. These carrier chains are fitted on lower sprocket wheels on a shaft journaled at the front lower part of the frame and on upper sprocket wheels on a shaft journaled in overhead bearings. The lower shaft is rotated to operate the carrier chains by a belt from a shaft at the rear of the machine, belts from the latter shaft also operating the bed roller and the feed-regulating wheel. To assure the positive feed of the lath to the carrier chains, a lever or knocker is fulcrumed on the chute frame to project its inner end above one of the lowermost laths in the chute, as shown in the small view. The outer end of the knocker is heavier than and adapted to raise its inner end, the knocker then resting on a stop fixed to the chute. The knocker is operated by fingers or lugs on an endless chain to which motion is communicated from the feeder shaft, each of the chain lugs, in passing, raising the outer end of the knocker, and causing its inner end to strike or knock the laths to assure their positive downward feed. The shafts which carry the upper sprocket wheels of the carrier chains also carry other sprocket wheels on which run endless carrier chains, with lugs or fingers adapted to take the laths on which the paper has been looped, and carry the laths and looped paper forward any required distance through a heated room or drying loft.



AN Erie, Pa., note says: The South Erie Natural Gas Co. struck a large well right in the thickly built up portion of the city on Nov. 23. The gas blew everything out of the well and could not be controlled. A number of wells will be put down in the immediate vicinity. Hon. F. F. Adams has begun to extend his gas plant by putting down more wells. There are fully 100 wells in and around Erie.

AN IMPROVED ELECTRIC RAILWAY SIGNAL.

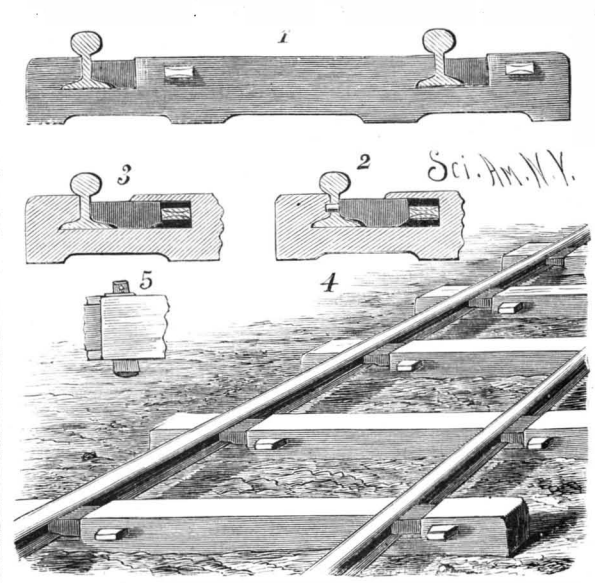
A simple form of signal board to be operated by an electro-magnet is shown herewith, and has been patented by Mr. Frederick W. Frith, of Bishop's College School, Lenoxville, Quebec, Canada. At the top of a suitable standard is a lantern-supporting shelf having at its ends vertical supports for the journals or pivots of a signal board, centrally in which is a lens or bull's eye. To the lower edge of this board is attached a weight to hold the board normally in a vertical position, and on one of the journals is keyed a pinion meshing with the teeth of a rack bar, pivotally connected at its lower end with a lever which carries at its free end an armature. This lever is fulcrumed on a hanger from the lower side of the lantern-supporting shelf, and the rack bar is guided in a keeper on the journal support. On the lower side of the shelf, above the armature on the lever, is held an electro-magnet, the conductors leading therefrom being arranged in connection with a battery and a push button, which may be located low down on the post, or at any convenient point, as in an outlookhouse. Then, by pressing the button, the armature is drawn against the magnet, throwing the lever and swinging the signal board to a horizontal position, and exposing the white light of the lantern. Upon the circuit being opened, the weight attached to the lower side of the board carries it to the vertical position with the colored lens in front of the lantern.



FRITH'S ELECTRIC RAILWAY SIGNAL.

AN IMPROVED RAILWAY RAIL TIE.

A railway rail tie designed to firmly hold the rails in position, and by means of which they can be readily locked to place, is illustrated herewith, and has been patented by Mr. Richard Jones, of Houston, Texas. Fig. 1 is a sectional view and Fig. 4 a perspective illustrating the application of this improvement, Figs. 2 and 3 being side views, the former showing a rail joint connection, while Fig. 5 illustrates the application of the key. At the proper distance apart in the top of the tie are transverse recesses to readily receive the rails, one side of each recess having a projection adapted to fit against one side of the rail web and the top of its base. On the opposite side of each of these recesses, centrally in the tie body, are apertures leading into each recess on the opposite side of the rail, where there is placed a retaining block of proper contour to fit against the rail web on its other side. These retaining blocks are each forced to place by means of a wedge-shaped key driven through a transverse slot in the rear of the apertures, each key being held to its place when in position by a cotter pin passed through an aperture in the small end of the key. In case the tie is to support a rail joint, the retaining blocks used in such cases are formed with a bolt-like projection adapted to pass through an aperture made therefor in the web of the rail, and into a like aperture in the opposite projection of the tie. To prevent lateral displacement of the



JONES' RAILWAY RAIL TIE.

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track, transverse ribs or projections are formed on the bottoms of the ties. A single tie of this construction can be readily placed in a track already laid without removing the rails.

Care of the Teeth.

At the meeting in Berlin last spring of the German Association of American Dentists, the best means of preserving the teeth were discussed, and Dr. Richter, of Breslau, said: "We know that the whole method of correctly caring for the teeth can be expressed in two words—brush, soap. In these two things we have all that is needful for the preservation of the teeth. All the preparations not containing soap are not to be recommended, and if they contain soap all other ingredients are useless except for the purpose of making their taste agreeable. Among the soaps the white castile soap of the English market is especially to be recommended. A shower of tooth preparations has been thrown on the market, but very few of which are to be recommended. Testing the composition of them, we find that about 90 per cent are not only unsuitable for their purpose, but that the greater part are actually harmful. All the preparations containing salicylic acid are, as the investigations of Fernier have shown, destructive of the teeth. He who will unceasingly preach to his patients to brush their teeth carefully shortly before bedtime, as a cleansing material to use castile soap, as a mouth wash a solution of oil of peppermint in water, and to cleanse the spaces between the teeth by careful use of a silken thread, will help them in preserving their teeth, and will win the gratitude and good words of the public.")

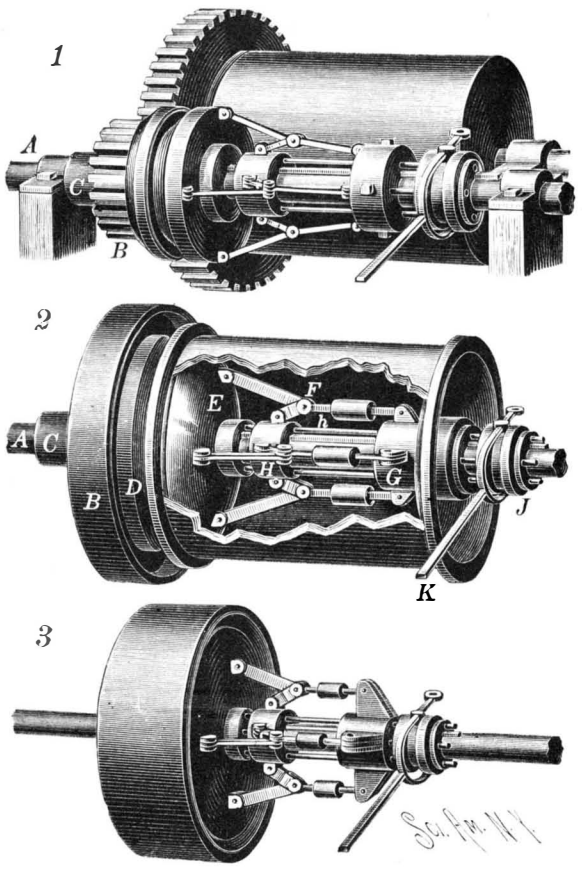
THE GREAT TRAVELING CRANE AT TRUBIA.

At Trubia the Spanish government has erected extensive works for the manufacture of the heaviest guns, and the establishment is now turning out armaments for the new steel cruiser Pelayo and other ships of war. Eleven inch and thirteen inch guns are the largest so far made.

Our engraving shows the new traveling crane lately erected at the Trubia works for handling these great guns and loading them upon the cars prior to removal to the coast. A beam of great strength is supported by its two ends upon a pair of hydraulic posts, each carried on a truck moved by an engine. Each truck forms, in fact, an independent locomotive. Suitable lifting gear and slings are arranged upon the beam, the gearing being worked from the ends of the beams. By means of this apparatus the heaviest guns may be quickly picked up, moved to the desired point, and the load deposited with the utmost precision. Our engraving is from *La Ilustracion Española.*

AN IMPROVED FRICTION CLUTCH.

The accompanying illustration represents a friction clutch especially adapted for hoisting machinery, in which a powerful friction and large bearing surface are required, and also designed for use on pulleys and



DENTON'S FRICTION CLUTCH.

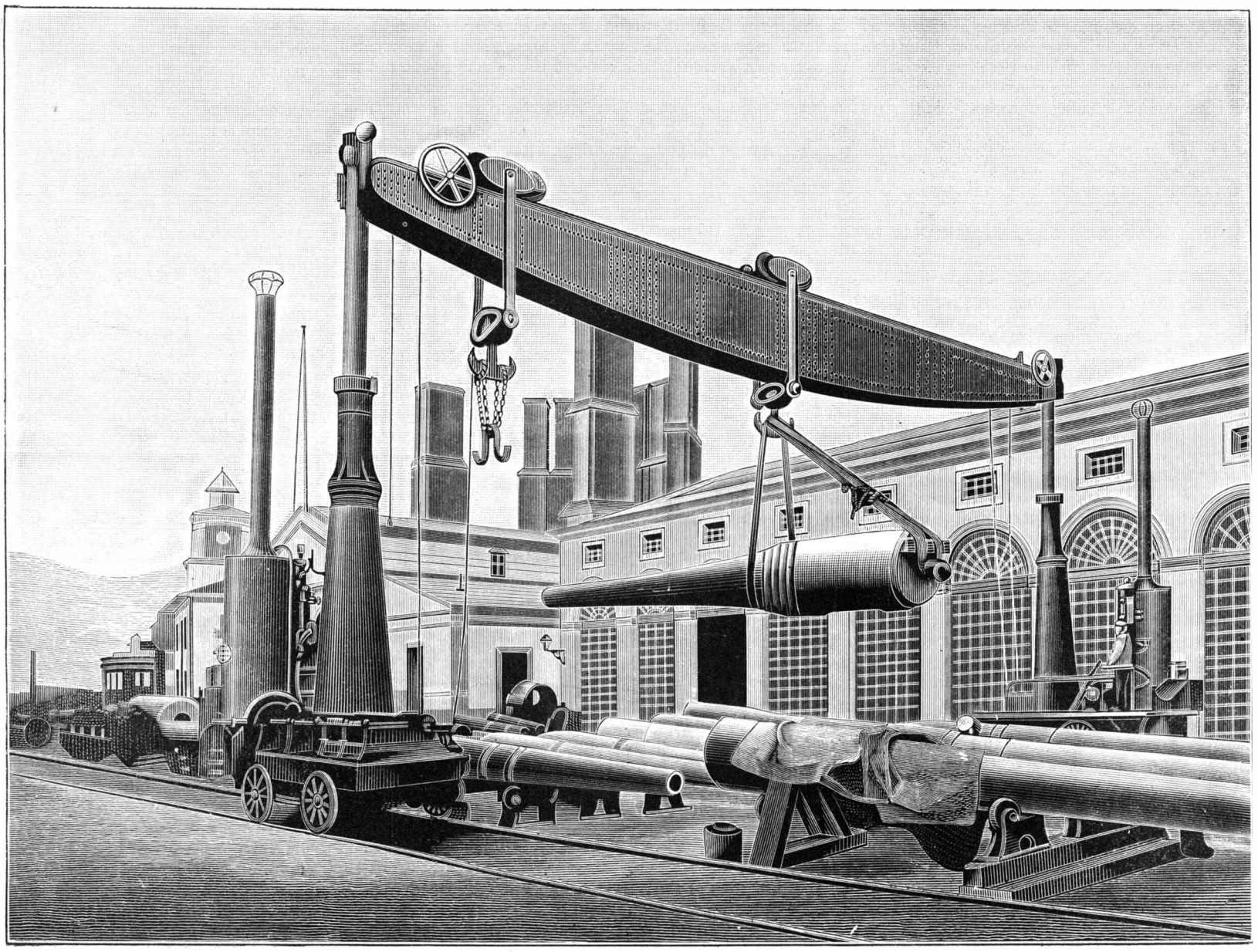
shafting. It has been patented by Mr. Daniel T. Denton, of Tower, Minn. Fig. 1 shows the clutch as applied on the outside of the hoisting drum, Fig. 2 illustrating its application within the drum, and Fig. 3 its use on a pulley and shafting. On the driving shaft, A, as shown in Fig. 1, is a loose pinion, B, meshing into a gear wheel on the drum of the hoisting machine, the outer face of the pinion resting against a collar, C, fixed on the shaft, while on its inner face is formed a friction flange, adapted to be engaged by a friction clutch wheel mounted to slide on and turn with the driving shaft. As represented in Fig. 2, where the clutch is shown applied within the drum, the pinion and gear are dispensed with, the drum itself forming a loose pulley, B, on the driving shaft, where D is the friction flange engaging the friction clutch wheel, E, which slides on a key secured to the driving shaft. The clutch wheel, E, is pivotally connected by toggle links, F, with a collar, G, keyed on the main shaft, the pivot points of the links being pivotally connected with a collar, H, also turning with and sliding on the shaft. To the collar, H, are secured rods, *h*, extending parallel with the driving shaft through apertures in the fixed collar, G, the outer ends of these rods being secured to a shifting collar, J, sliding on the key on the driving shaft, this collar being shifted forward and backward, to engage or disengage the clutch, by the lever, K. By pushing the lever to bring the toggle links into a straight line, the clutch wheel, E, is thrown into frictional contact with the flange, D, of the hoisting drum. Fig. 3 illustrates the similar application of the clutch to a loose pulley on a driving shaft.

Accidents from Electricity.

Two more instances of the omnipresent danger due to the present systems of electrical distribution have been afforded during the last few days in this city. On the night of November 30, two clerks were engaged in carrying a metal frame showcase from the sidewalk into a store on Eighth Avenue. One of them stepped upon an iron grating, and as he did so the metal frame of the showcase came in contact with an arc lamp hanging over their heads. Suddenly the unfortunate man dropped his end and fell insensible. He never recovered from the shock. A new name is to be added to the long list of the killed.

On the night of December 3, the passengers in a Third Avenue Elevated Railroad train were startled by hearing a noise like hail emanating from the roof of the car. It proved to be due to electricity. The car had come in contact with a low hanging wire, and had probably drawn it along until it crossed a live wire. It is said that two of the passengers in the car received shocks.

The problem of safe distribution of electric energy seems to be a difficult one. Even when the wires are underground they can shock pedestrians, and many instances are on record of men or horses being shocked from subterranean lines. Moreover, under the present system of conduits as established in New York, electric subway gas explosions are added to the list of accidents. But a few days ago an electric conduit in Minetta Street exploded, blowing out manhole covers and involving great possibilities of damage to life and property.



THE GREAT TRAVELING CRANE AT TRUBIA.

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ARMOR PLATE FOR WAR SHIPS.

The numerous visitors to the exposition remarked with great interest, in the pavilion of the Minister of War, the huge armor plates exhibited as specimens of the armoring now applied in our navy.

The crowd stopped before these heavy and imposing masses, and were filled with astonishment on thinking of the power of the armorclads that are capable of floating with such a sheathing, and with more astonishment still, perhaps, on thinking of the power of the machinery that metallurgy now has at its disposal for obtaining such plates. The preparation of the military products serving for attack and defense was, in fact, the starting point of most of the progress realized for the last thirty years by metallurgy, and of the incessant development of its machine tools.

In this continuous contest that has been going on between the attack and the defense, between the cannon and the armor plate, it is from metallurgy that each has demanded arms. The artillerist has endeavored to obtain a lighter and, at the same time, a more resistant gun, capable of giving, through the elongation of the chamber, a greater initial velocity to the projectile; and for the projectile itself, he has desired a harder and harder metal, capable, without breakage, of supporting a continually increasing energy of impact against armor plates, which themselves are becoming more and more resistant.

The engineer of naval constructions, on his part, has endeavored to give his armor plates all the resistance possible, by increasing the thickness up to extreme limits, as well as by the best distribution of the metal, the most scientific study of forms, and especially the use of harder and harder metal.

Hence result the ever new exigences in the manufacture of guns, projectiles, and armor, that have necessitated the use of larger and larger ingots, with maneuvering apparatus and rough forging and finishing tools, and the adoption of steels whose physical qualities of hardness, toughness, and homogeneousness have always gone on increasing.

It is thus that metallurgy has been led to develop its tool equipment continually from all points of view, until it now works masses weighing from 90,000 to 100,000 pounds, and which forgemen of former times would never have thought of handling. It has scientifically studied the metal to be elaborated, and has succeeded thereby in treating it under minutely determined physical and chemical conditions, thus making of the forge as it were a laboratory on a large scale.

Our national metallurgy can claim its part in the great progress realized by our armament, and such progress, which will allow us to await the contests of the future with more security, has been recognized by foreigners themselves, who have ordered numerous products from our national works.

The application of armor plate to ships was proposed by the eminent Dupuy de Lome in 1845, but the idea was not carried out until 1854, on the occasion of the Crimean war, and upon the personal intervention of Napoleon III. At that time there were built five floating batteries, which were protected with 4 inch armor plate of iron.

These vessels, which constituted genuine forts rather than ships, reduced the fortifications of Kinburn in a few hours on the 17th of October, 1855, and, owing to their protective armor, were but slightly injured by the enemy's fire.

This success decided the application of metallic armor to sea-going ships, and the type of it was created by Dupuy de Lome. The Gloire was the first armorclad, and was followed by the Couronne, Flandre, Magenta, etc. The weight of the cuirass was then about 900 tons, and the number of men in the crew was from 500 to 600. Later on, about 1865, in view of the progress of rifled artillery, it was found necessary to increase the thickness of the armor plate to eight inches, and then came the type of vessels represented by the Ocean, in which the armor belt extended clear around the ship, and descended 6½ feet beneath the water, and rose in the center to form an armored redoubt carring four 10½ inch guns.

At the four angles of this redoubt there were as many turrets armed with 9-inch guns. Analogous arrangements are found on the Redoutable—one of the first ships constructed of iron. The substitution of metal for wood permits of reducing the weight of the hull and increasing the weight of the armor, the latter reaching 13½ inches at the load water line in the vessel under consideration. On this ship, the first one provided with armored deck, there is an octagonal redoubt protected with 11¾-inch plate and armed with four 10½-inch guns. The armor plate employed is iron and is 2¼ inches in thickness.

In the Amiral Duperre and the Amiral Baudin, the cuirass reaches its maximum thickness, so to speak, being 21½ inches at the center of the load water line and 15½ inches beneath. The huge mass thus exceeds the weight of 8,360,000 pounds, and the elements of which it consists weigh no less than from 35 to 40 tons each.

Armor plate has at the same time undergone an essential transformation that has been necessitated by the progress of artillery. It became necessary to look for a metal harder than iron—which is too easily penetrated; and so steel has finally been applied to the manufacture. At the same time a mixed metal has been created, consisting of an iron plate covered with a layer of hard steel, designed to break the projectiles at the moment of impact.

The turrets of the Amiral Baudin were manufactured of mixed metal by the Compagnie des Forges, of Chatillon-Commentry, and the exhibit of this establishment included a curved plate weighing 70,000 pounds, and which was 13 feet long, 6½ wide, and 20 inches thick. This plate is represented lying upon the ground in Fig. 2, page 406. As for iron plates, we may mention the large one which was the admiration of all the visitors, and is shown in Fig. 1. This plate shows the result of the shot of five projectiles, the impacts of which are nearly tangent. The plate supported this test without being fissured, a result that bears witness to the great malleability of the metal. This consideration of malleability is of capital importance in deck plates, in which rents might lead to leakages, and it explains the preference shown up to the present for welded iron for the protection of decks.

After the Amiral Baudin, the thickness of armor plates tends to decrease, and upon the four armorclads not yet finished it is reduced to 18 inches at the load water line.

If, with Engineer Hauser, we consider the course followed since the first armorclads up to the Amiral Baudin, we see that the total displacement has nearly doubled, passing from 5,800 to 11,400 tons, the wooden hull is replaced with one of iron, passing from 14 per cent to 35 per cent of displacement, and the armor passes from 4½ inches to 21½ inches, with a weight going from 16 per cent up to 35 per cent. The guns, first placed in port holes, have gradually been relegated to the turrets, and the armored redoubt has been entirely suppressed. The number of the crew has not been modified much, for although that of the Marengo reaches 750, we find that of the Amiral Baudin to be but 500—a number less than that of the Flandre.

In the artillery properly so called, the calibers of the guns, and especially the lengths of the chambers, are continually increasing in order to attain greater and greater velocities with slow-burning powders; and 12½ and 13 inch guns are now being constructed that have a chamber length of as many as forty calibers. The Societe des Forges et Chantiers de la Mediterranee exhibited a specimen of such a gun designed for the turret of a Japanese armorclad, and with which may be obtained a velocity of 229,600 feet at the muzzle.

The invention of new explosives, making it necessary to protect the live works as well as the men at all exposed points, and the desire to lighten the ship so as to give it that rapidity of evolution which is becoming more and more necessary, make it appear as if a new transformation would take place in the armor plating of ships. At all points where fissures would not be of much consequence, an endeavor will be made to employ very hard metal, capable, with a smaller mass, of arresting projectiles that would pass through thicker iron plates, and the softer and more malleable metals will be reserved for points where fissures are to be particularly feared. The progress that has been made in recent years in the metallurgy of steel fortunately permits of such a programme being carried out, and the exhibit of the Company of Chatillon-Commentry, in particular, included complete series of plates of all degrees of hardness, perfectly adapted to every application that may be had in view.

The large plate shown in Fig. 2 forms the extreme series of the soft metal. It has a resistance of penetration one-fifth greater than that of welded iron, and at the same time presents a perfect homogeneousness that iron could not possess, and at least an equal malleability.

This may be seen by an examination of the indentations made in the tests with normal and oblique firing, for such results have never been obtained with iron plates.

This metal is peculiarly well adapted for the sheathing of deck plates. Afterward came plates of medium hard metal, having an excess of resistance to perforation a quarter greater than that of iron, and which are adapted for the belts of ships. Finally, we have hard metal plates that are better adapted for the construction of light shields of all kinds, and the resistance of which exceeds that of iron by one-third. We have here a series of important results obtained by the application of scientific methods in the working of steel, and we have thought it would be of interest to make them known, by reason of the services that our navy can hope from them.—*La Nature.*

New Photographic Lens.

M. Ch. V. Zenger employs two correction lenses of magnesium glass of the same focal length, one concave and the other convex. The focal length of the system is the same as that of the spherical mirror. The time of exposure for stars of the same size is reduced to a third or a quarter.—*Comptes Rendus.*

Bending the 110 Ton Gun.

It is stated that a 110 ton Armstrong gun has bent during test. No details have as yet reached us. Mr. James A. Longridge, C.E., and General Maitland give the following particulars with regard to the life of heavy guns:

It appears that the 110 ton gun—16¼ inches—will fire 95 ordinary rounds; after this the gun is unfit for service. The 67 ton—13½ inches—will fire 127 rounds, and the 45 ton gun—12 inches—will fire 150 rounds, after which these guns are unfit for service. The cost of the 110 ton gun is £16,500, the 67 ton gun £10,900, and the 45 ton gun £6,300. Thus the cost of the 110 ton gun alone will be for each discharge of shot £174, for the 67 ton gun £86, and for the 45 ton gun £43. The cost of a single round for material alone for the 110 ton gun is as follows:

	£	s.	d.
900 lb. of powder	70	0	0
1,800 lb. projectile	80	0	0
Silk for cartridge	3	0	0
Deterioration of gun (life of gun taken at 95 rounds)	174	0	0
Total net cost of each round	327	0	0
For the 67 ton gun:			
520 lb. of powder	40	10	0
1,250 lb. projectile	55	10	0
Silk for cartridge	2	0	0
Deterioration of gun (life of gun taken at 127 rounds)	86	0	0
Total net cost of each round	184	0	0
For the 45 ton gun:			
295 lb. of powder	23	0	0
714 lb. projectile	31	0	0
Silk for cartridge	1	0	0
Deterioration of gun (life of gun taken at 150 rounds)	43	0	0
Total net cost of each round	98	0	0

The 67 ton gun would penetrate 27 inches of wrought iron at 1,000 yards, and the 45 ton gun would penetrate 20 inches of wrought iron at the same distance.—*The Engineer.*

How Wax Figures of Celebrities are Produced.

The following is an abstract from an interview between the artist and a reporter for the New York *Sun:*

I can always find young women willing to pose, and, nine times out of ten, obtain a subject whose face so closely resembles the photo in question as to answer all purposes.

The "model" visits the studio and poses as the sculptor desires. First, a cast of clay is made of such portion of her anatomy as is required. About this is constructed a plaster of Paris mould, into which is poured a preparation of wax known only to this sculptor. The figure formed in this way is remarkably lifelike, but by no means equal to the figures produced when a plaster cast is taken of the subject supposed to represent the individual the sculptor desires. Here it is the hard work comes in, and here it is the "model" wishes she had never agreed to undertake the task.

She is positively assured that no harm will befall her and that she will be at liberty inside of five minutes. The assertions of the sculptor restore her confidence, and she says she is willing to submit to the ordeal. She is seated in a chair and the artist retires to an adjoining room. She becomes frightened, and wonders what is coming next.

The sculptor comes in carrying with him the utensils of his trade. Again the girl is assured no harm will befall her, and she is requested to open her mouth. When she complies with this request, a quill toothpick is inserted between her teeth and she is told to keep still. In less time than it takes to tell it, her face is covered with plaster of Paris.

The quill toothpick allows the model to breathe, and the plaster of Paris, which is an inch thick, remains on her features a minute or more, until it is set. Then it is carefully taken off. The model receives from $1.50 and upward, and her features will appear in some shop window later on as a fac-simile of some woman with a national reputation.

These figures or busts are made to order for the purpose of supplying models for stores and museums. Aside from supplying museums, the hardest work in this unique business is to furnish models for hair-dressing establishments.

Spontaneous Combustion of Cotton Bales.

The Boston Manufacturers' Mutual Fire Insurance Company has issued a circular calling attention to the danger of spontaneous combustion of bales of cotton which have become impregnated with cotton seed oil. Two bales are cited which had absorbed two hundred and fifty-six and one hundred and seventy-five pounds respectively. Leakage from barrels contained in the same cargo might account for the occurrence. Such cotton is very liable to heat and to break out into active combustion. The more frequent fires in cotton ships and warehouses, it is thought, may be accounted for on this basis. It is suggested by the company named, whose circular is signed by Mr. Edward Atkinson, the eminent statistician, that cotton bales should be watched and inspected for this source of danger. It is a good note of warning, and should be given full attention by all interested.

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A NEW SYSTEM OF RAPID TELEGRAPHY.

To those familiar with the history of telegraphy and other great inventions, it appears strange that the invention of Prof. Morse should have retained its identity through all these years of telegraphic development and improvement. The original code, and substantially the original instruments, have been and are used to a greater extent than any other.

The main improvements in telegraphy up to the present time have the Morse system as a basis, and consist principally in increasing the capacity of the telegraph lines by duplexing and quadruplexing, and by the system known as "Rapid Telegraphy," in which messages are transmitted by means of a perforated strip of paper, and received upon a strip of chemically prepared paper. In all these systems the Morse code is used, and as a consequence, the message requires translation into characters which are legible to the generality of people.

Other systems of telegraphy in which the messages are delivered in print are used to a limited extent. Among these are the "Phelps printer" and the type writer telegraph; but these, as compared with the other systems referred to, are slow, and are incapable of being duplexed or quadruplexed.

For years, inventors have known that great possibilities lay in a practicable means of synchronizing instruments at the end of a telegraph line, and many attempts have been made to secure a simultaneous duplication of mechanical motions at points distant from each other. This result has been accomplished by means of the pendulum, and by the phonic wheel of Lacour; but the speed attained by these means falls far short of the ability of the current to respond in the transmission of impulses or signals.

Our attention has recently been called to an entirely new method of obtaining perfect synchronism at a very high rate of speed. This method, together with a new telegraphic code and transmitting and receiving mechanism, are the invention of Mr. J. Harris Rogers, who has also added a simple and effective punching attachment to be applied to any type-writing machine, so that the messages may be written by a type writer and simultaneously cut in the transmitting strip, the whole being combined into a system which can be operated by any person of ordinary intelligence at a speed far greater than that attained by any other system of telegraphy.

This system is fully illustrated in our front page engraving and in the diagram, Fig. 9. Fig. 1 shows the transmitting portion of the apparatus in perspective; Fig. 2 shows the manner of using the detached punching machine; Fig. 3 represents an electrical punching machine connected with an ordinary type writer; Fig. 4 is a view of the printed strip delivered by the receiving machine; Fig. 5 represents the code and a portion of a perforated strip ready for transmitting a message; Fig. 6 shows the machine receiving the message; Fig. 7 is a plan view of the printing device; and Fig. 8 is a side elevation. This system has been tested between Washington and New York in the presence of many well-known experts. The machines demonstrating this method were examined by us at the offices of the Visual Synchronism Co., at 34 Broadway, N. Y. W. B. Hopkins, general manager.

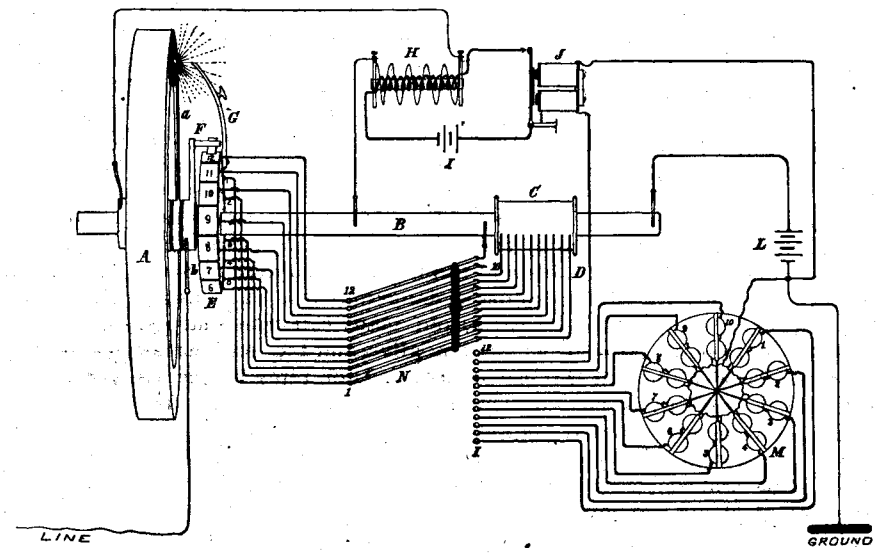

Fig. 9.—NEW SYSTEM OF RAPID TELEGRAPHY—DIAGRAM OF CIRCUITS.

As the synchronizing apparatus is the vital portion of the system, we will first describe how the instruments at opposite ends of a long line are made to revolve synchronously. At the ends of the line are arranged instruments which are precisely alike, therefore a description of one will answer for both. Upon a shaft, B, is mounted a heavy fly wheel, A, about fourteen inches in diameter, and upon the boss of this wheel is placed a collar insulated from the boss and connected with a wire arm, *a*, which extends into a recess in the rim of the wheel, A, to a point within striking distance of the metal of the rim. This wire is otherwise insulated so that when a secondary discharge is sent through it, a spark will appear in the recess of the wheel. The secondary circuit through which the spark current is sent is generated in the induction coil, H. One terminal of the induction coil is connected with an insulated ring on the boss of the wheel, A, by means of a brush, and this ring is in electrical connection with the ring which supports the wire, *a*. The other terminal of the induction coil is connected electrically with a brush which contacts with the shaft, B. One end of the primary wire of the induction coil is connected with the battery, I; the other end is connected to the back contact of the armature lever of the relay, J, and this armature lever is connected with the remaining pole of the battery, I. Whenever a current passes through the relay, J, the primary circuit of the induction coil, H, is broken, and the impulse set up in the secondary wire of the coil produces a spark in the recess of the wheel.

Now it is evident that if the wheel, A, at the distant station can be made to send an electrical impulse through the relay, J, once during each revolution, this will cause a spark to appear in the recess of the wheel, A, once during each revolution of the wheel at the distant station. If the spark in the recess of the wheel is produced at each time at the same point in the revolution of the wheel, it shows that the two wheels are synchronous; but if the spark appears at different points in the revolution of the wheel, it clearly shows that the wheels are not synchronous. If the spark appears to travel forward, the receiving wheel, A, is revolved slower than the distant wheel. If, on the contrary, it appears to travel backward, the speed of the receiving wheel is too high. The power is applied to the receiving wheel in such a manner as to produce an excess of speed, and the synchronizing is effected by applying either a mechanical brake or the finger or thumb to the periphery of the wheel until the speed of the receiving wheel is so reduced as to cause the spark to appear stationary. When this occurs, the instruments are in condition for transmitting or receiving messages.

Surrounding the shaft, B, there is a sun wheel, E, carrying on its periphery twelve commutator plates, numbered from one to twelve. The plate is connected through the multiple switch, N, and brush with the shaft, B, and the shaft, B, receives a current from the brush connected with one pole of the battery, L, the other pole of the battery being grounded, as shown.

Upon the boss of the wheel, A, is secured a metallic ring which is insulated from the boss, and has an angled arm, F, which reaches over the stationary sun wheel, E, and carries a brush which contacts with the commutator segments, 1, 2, 3, 4, 5, etc. A brush, *b*, touches the ring of the arm, F, and is connected with the line. It will be seen that whenever the brush carried by the arm, F, touches the commutator segment, 12, the circuit is completed over the line, and if this happens at both ends of the line simultaneously, both of the relays, J, will be worked, and the sparks will appear in the two wheels at the same time.

The sun wheel, E, is movable around the shaft, B, and is provided with an arm, G, opposite the segment, 12, which is used to move the sun wheel whenever the spark appears stationary at a short distance from its normal position. By moving this arm the sun wheel, E, with its commutator segments is brought into proper relation to the wheel, A.

Upon the shaft, B, is mounted a metallic cylinder, C, over which the perforated transmitting strip is carried with an intermittent motion, being moved forward one step for each revolution of the shaft, B. Upon the cylinder, C, rests a series of contact springs, D, numbered from one to ten, and corresponding with the commutator segments having the same numbers. The springs, D, are brought into electrical communication with the commutator segments by the multiple switch, N, and the connected wires, as shown. When the perforated transmitting strip is passed over the cylinder, C, the springs, D, rest upon the paper, or upon the cylinder, C, through the perforations of the paper.

During each contact of the series of the springs, D, with the cylinder, C, a series of contacts will be made by the brush carried by the arm, F, with the commutator segments, and there will be a correspondence in the frequency of these contacts and the position of the springs, D, in contact with the cylinder, C, so that when this brush contacts with any segment of the commutator, the brush of the receiving instrument will contact with the same segment, and will therefore actuate a section of a segment of the receiving instrument which corresponds to the same section of the transmitting instrument.

It will therefore be seen that as long as the sparks in the wheel, A, remain in a fixed position, or so long as the arm, E, can be moved so as to bring it opposite the cavity as the spark is formed, there will be perfect synchronism, and messages may be transmitted with perfect accuracy and with a speed which produces ten or more impulses over the line for every revolution of the wheel.

The code of this system consists of ten marks, made in different positions and at different angles, the whole when combined forming a monogram like that shown in Fig. 4, and in this monogram are the elements of all of the letters of the alphabet. It is true that perfect Roman letters cannot be made from these elements, but an approximation to such letters can be formed, and the message is as legible as any printing. The marks of this monogram are produced by ten arms arranged radially, and carrying armatures which are operated by an equal number of electro-magnets. These electro-magnets are numbered from one to ten.

As shown in the diagram, the instrument is ready for the transmission of a message. By transferring the multiple switch, N, to the contacts, I, the series of magnets, M, of the receiver will be thrown into communication with the commutator segments, while the relation of the relay, J, to the system still remains the same. The apparatus is provided with a feed mechanism which carries a strip of paper under the printing arms, the feed being effected by a step by step motion, one step being produced by every revolution of the shaft, B.

Every turn of the wheel, A, produces a character or letter, and, as a consequence, when the wheel makes 1,000 revolutions per minute, 1,000 characters or about 200 words will be transmitted. If the speed is doubled, it goes without saying that the number of words will be increased in the same proportion. By the old systems of synchronizing, the greatest speed attained is 300 revolutions per minute. In the experiment of the Visual Synchronism Company above referred to, a speed of 2,500 revolutions per minute was reached.

The printing is done through the medium of an inking ribbon, so that the characters are perfect and durable, and the message is ready for delivery as soon as it leaves the machine. The strips are prepared for transmission by a small electric punching device used in connection with an ordinary type writer, so that while the message is written out upon the type writer, the paper strip is prepared for the transmission of the message.

A method of preparing strips which is somewhat more rapid than that of the type method is illustrated by Fig. 2, in which a ten-keyed perforator is used. With this machine the preparation of the message almost equals stenography in point of rapidity. It is thought by the promoters of this system that an active manipulator could transmit a speech directly by means of the ten-keyed punching machine without calling in the aid of stenography. A portion of the speech could be recorded on the strip, and the strip torn off and carried to the transmitting machine, and transmitted while another strip was in process of preparation.

It is obvious that the speed of the transmission of words could be greatly increased by adopting a stenographic code, but this would necessitate the translation of the message.

The transmission of secret messages by this system is a feature of great importance. It is plain that any person having a typewriting machine with a punching attachment, or a ten-keyed punching machine, can prepare messages apart from any connection with the telegraph office, and send such messages to the telegraph office for transmission. As a precaution, the type-written record will be retained by the sender of the message, for future comparison with the transmitted message, if this becomes necessary.

By a simple alteration of the punching mechanism, each patron of the telegraph can have a code of his own by which messages may be transmitted, which can be read only by the aid of a key furnished by the sender. The value of this feature will be appreciated in many lines of business where it is of importance to maintain secrecy.

It is obvious that all the indistinctness and uncertainty common to the use of chemical paper is avoided in this system. The ill effects of the static charge of the line are prevented by a duplication of the relay, which permits of maintaining a continuous current upon the line. A great advantage is gained in the pause of the contact of the transmitting contact springs, thereby giving ample time for the current to act to its fullest extent.

It is, perhaps, unnecessary for us to enlarge upon the advantages of this system, as they will be apparent to any one who will examine it after acquiring a moderate knowledge of other systems of rapid telegraphy.

TEMPERATURE OF THE MOON IN SUNSHINE.—The most recent researches of Professor S. P. Langley indicate that the mean temperature of the sunlit lunar soil is probably not greater than zero Centigrade, or 32° Fah.

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POISONOUS FISH OF THE INDIAN OCEAN.

BY NICOLAS PIKE.

All early voyagers to the Indian Ocean speak of the great beauty and variety of its fish. Commerson and Bougainville, in their voyage round the world in 1779, remained for a time at the Isle de France (now Mauritius) and collected over a hundred different species, of which nearly two-thirds were new to science, and of nearly all they made notes and sketches. After Commerson's death the collections were set to Buffon, but he neglected them, and later they fell into the hands of Lacepede, who described them very imperfectly from the dried specimens. Dumeril, long after, found part of the MSS. in a garret over the Museum of Paris and some sketches in Strassburg Library. They eventually found their way to Cuvier, who acknowledged their great use in preparing his "Natural History of Fish." Many distinguished men have collected fish, but few have written any account of them—past a few anatomical notes. Dr. Desjardins wrote considerably, but his MSS. have all been scattered; and M. Lienard not only wrote, but gave a valuable collection of fish to the Museum of Paris and Port Louis, Mauritius; but little is generally known of his writings.

During my residence at the latter place I had exceptional chances for collecting and studying these fish. I was fortunate enough to procure 500 species, now in the Museum of Comparative Zoology of Cambridge, Mass., where twenty-seven were described as new species and one a new genus.

No idea of their beauty can be formed from dried or alcoholic specimens; they must be seen when fresh from the bright waters of the ocean. Brilliant as are their colors, there is no place in the world where there are more that possess deleterious and even deadly qualities. So much is this the case that the government has seen fit to impose heavy fines and imprisonment on the fishermen who bring such fish to market. It was thus difficult to procure specimens of these fish, mostly unknown elsewhere; so I had to watch for the boats that came inshore outside of the city, and get them from the men, who saved them for me when caught in their seines or on their lines. Many of them are as dangerous to handle as they are poisonous for food; and others with terrible weapons in their fins are eaten when deprived of them.

Of the latter class are the *Lafs* I have written of before, but every spine is cut as soon as caught, the flesh being innocuous. The *Machaourau* (Arius) and *Cordonnier* (Teuthis) are very nice pan fish, but every fin must be cut off before they come to market. The magnificent yellow-tailed *Croissant*, glittering in scarlet, yellow and purple (a Serranus), grows very large, and is termed a *soulard*, or drunken fish, from its effects on its victim. They do not stop here, but the man grows delirious with sharp intestinal pains, and the whole system is deranged. I was astonished to see some fine ones landed, though not taken to market, and a fisherman told me that when well salted and prepared it can be eaten,

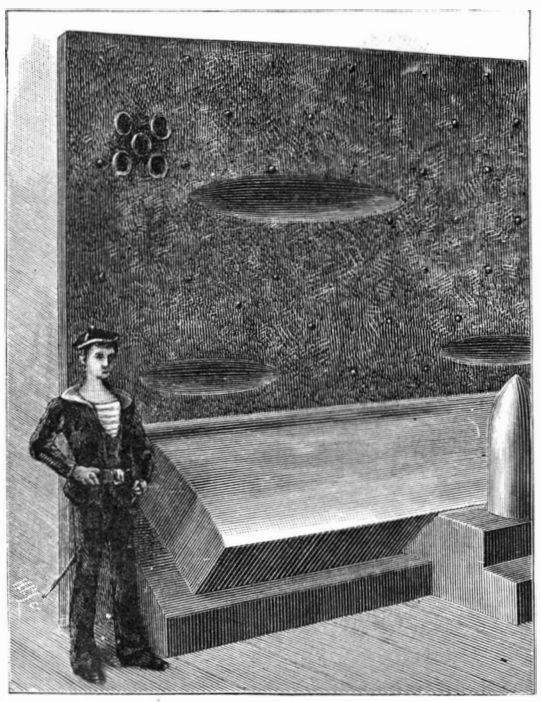
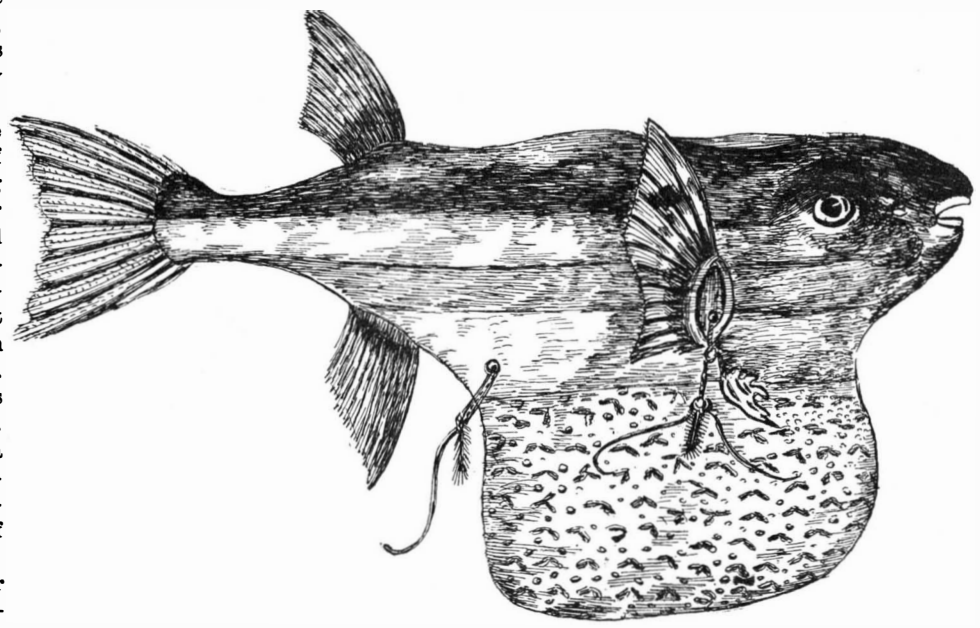


Fig. 2.—DECK PLATE OF THE SUCHET—PLATE OF THE FORMIDABLE.—[For description see page 404.]

but it would be dangerous for any but an expert to risk it. Strange to say, the white-tailed *Croissant* is quite harmless and constantly eaten, though wherein lie the poisonous qualities of the one, to all appearance the same as the other, with the exception of the tail, has yet to be discovered. A similar fact is found in fish of the genus *Genyoroge*, called by the Creoles *Giblots*. They are mostly yellow, some with lines and others with a dark spot. The former are eaten, but the latter are always rejected. One of the family, of an intense crimson, with yellow fins, was brought to me, and I was cautioned not to let even a cat or dog get any part of it, as it was sure death in a few minutes. It is a curious fact that in nearly all the poisonous fish the most vivid colors occur. The pretty, harmless-looking little pink and yellow fish Dr. Steindachner did me the



POISONOUS FISH OF THE INDIAN OCEAN.

honor to name the *Pikea lunulata* is of the same deadly character. With the exception of a few of the scarlet rock cod or Serranus family, the fish with gray coats are the finest eating and the safest. The edible, bright colored ones are mostly coarse and strong to the taste—many so much so that they have to be skinned before cooking.

In the family of the *Gymnodontes* we have some of the most singular and poisonous fish of the ocean. Most of them go by the name of *Bourse*, and can inflate the body to double and treble its ordinary size. Some are covered with spines so dangerous it is exceedingly difficult to handle them, and many can bite sharply. I had a large *Diodon* sent me alive, and I asked the man who brought it if it would bite. For reply he picked up a thick piece of coral and put it in the creature's mouth, when it snapped it off as if it had been a pipe stem. Another *Diodon* was presented to the museum, called *Bon tau*, or porcupine fish. Every part of its body was covered with spines turned every way, so that it was almost impossible to touch it without pricking the fingers. It was brought to the museum with a rope round the body; but the taxidermist who skinned and stuffed the fish lacerated his fingers and they quickly ulcerated, the hand and arm swelled, and he was unable to use them well for months after.

Another fish of the same family, the *Tetrodon lunaris* (see plate), or *Bourse toto*, is equally with other Tetrodons very poisonous to man. It has no spines on the body, but has the curious appendage below that can be extended and collapsed at pleasure, covered with transparent three-sided spines of irregular shape. So many of the family have the sac that it gives the Creole name to them, viz., bourse or purse. Though its flesh is so deadly poisonous to man, like sharks and other ferocious creatures, the *lunaris* has its enemies that live and thrive on it, and doubtless in time destroy it. In one sent to the museum holes were perforated through the thick skin on the side and in the tender part of the gills, through which the parasites had made their way, and must have been very annoying to the fish. They were a bright purple and yellow. This bourse is very handsome, of an imperial blue on the back, the sides white, with a broad gold stripe extending to the eye, and the sac milk white, tuberculated between the spines. It averages about 12 to 15 inches long, and the bourse can be distended to 6 or 8 inches deep. Numbers of these fish float in the shallow waters within the reefs. Some without spines are often left by the tide on shore, which look like leather balls. The boys amuse themselves pitching them about, for, when perfectly distended, the head is almost invisible and they bounce more like a ball than a fish. When tired of playing with them, they kick them back into the water, and they soon make off. When on shore, in a collapsed state, they lie to all appearance dead; but as soon as touched by the returning tide, they recover and swiftly swim away.

Knowing my proclivities, my friends occasionally sent me a rare fish, and one day I was astonished to see a cart arrive at my door with a fish over six feet long and weighing 570 pounds! It was said to be a *Soutre*, or Serranus, and very rare, but poisonous. For hours my place was besieged by people come to see the big fish. It nearly proved a white elephant, for it was no joke to dispose of 570 pounds of poisonous flesh to get the skin. Numbers of colored men and women, Malabars, and Creoles came for it, but after what they told me I did not dare to give it to them. They clamored loudly for it, saying, "It was too bad to waste so much good flesh." At length an old fisherman, who came out of curiosity, assured me it was not the *Soutre*, but a fish that looked like it, and one he had caught years ago, and safe to eat. The poor, hungry wretches yelled with delight, and such a scene took place! As fast as the flesh could be cut out it was seized, and even the entrails and gills, and, as I heard no more about it, I suppose it was edible. It now figures in the museum at Cambridge, Mass., and Mr. Bliss wrote of it that it was supposed to be the *Serranus horridus*, which grows very large in the Indian and Chinese seas.

There are two species of *Grammistes*, black or brown, with white and lilac stripes, very poisonous, and the fishermen particularly dislike to catch them in their nets. They have an odor of strong, ill-smelling soap, that remains long on the hands after handling, as I know to my cost when skinning one. Ordinary soap and water has no effect on it, and the strongest perfume scarcely covers it. These are not all the dangers in tropical seas to fish eaters. Very often the gray mullet, one of the best eating fish in these waters when fresh, is rendered poisonous by the food taken by it occasionally. To give an instance: A friend and myself had two young mullets boiled for breakfast—one for each. After a hearty meal, in about an hour I began to feel hot and grew red in the face. Presently the color spread from my hands up the arms, and from that over the whole body in waves. I took a strong dose of carbonate of soda, by my friend's advice, and lay down, for I staggered as if intoxicated. I grew red, hot, and stupefied, and at last slept very heavily for some hours. The fever had left me in sleep, and I was ghastly white on awaking, and felt weak for several days. My Creole servant told me my mullet had eaten of the "coral flowers," as he called the coral polyps, and hence the poisoning. These fish are so greedy that often, when the large polyps are expanded, they snatch at them and get a large mouthful before it has time to contract. My friend suffered no inconvenience, as his mullet had, I suppose, taken the ordinary fish food. In consequence of this, many refuse to eat of the mullet at certain seasons of the year.

It is a curious fact that with all the abundance of fish in Mauritius it is impossible to salt it so that it will keep more than a few days. There is a species of *Teuthis* slightly salted, called *Corne*, but it has to be done fresh every three or four days, as it decays so rapidly. A little fish is salted in the St. Brandon Isles, north of Mauritius; but the bulk of the article is brought from the Cape of Good Hope and the United States.

The Mountain Sphinx.

In Surrey County, North Carolina, there is a remarkable natural curiosity in the shape of a mountain resembling the famous sphinx of Egypt in all its details. It lies east of the Blue Ridge mountains, on the Piedmont plains, like a gigantic lion; its body at

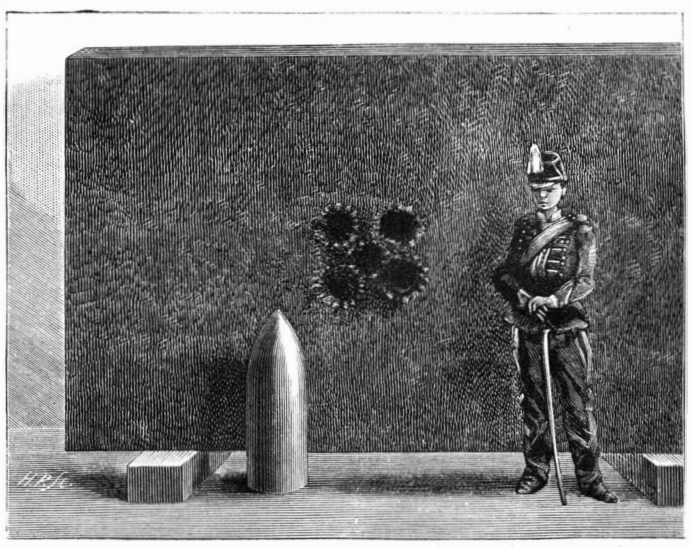


Fig. 1.—IRON TEST PLATE FROM THE FORGES OF CHATILLON-COMMENTRY.—[For description see page 404.]

right angle to the ridge and with head reared aloft as if in the act of rising. The head is of solid rock, several hundred feet in height. The shoulder and breast are finely proportioned, and at the distance of a few miles it looks like a thing of life and intelligence. It rises about 1,500 feet above the plain, and can be seen for a distance of many miles.

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THE NITRATE OF SODA WORKS AND FIELDS OF CHILE.

Our sketch at the top left hand shows the works of the Liverpool Company. The upper sketch at the right gives an idea of the plains where the rough nitrate is mined.

The lower engraving is a front view of the works of the Primitiva Co., which is the most completely fitted up of any of the corporations engaged in this industry.

Nitrate of soda has acquired each year a more important position in commerce and industry. It is used to make nitrate of potash or saltpeter by double decomposition with chloride of potassium. This is done at the powder works, the resulting saltpeter being used for the manufacture of gunpowder. In Europe it is used in immense quantities as a fertilizer. The agriculturists there use it as a source of nitrogen. In the United States the farming practice is so peculiar that little success has attended the efforts to introduce it here on the scale that it seems entitled to attain. If mixed in with other materials to make up a fertilizer, it destroys the pulverulence of the mixture, so that it can no longer be fed regularly by mechanical seed planters or drillers. This mechanical difficulty, trifling as it seems to be, has sufficed to keep it out of American fertilizers. If any one could invent a method of mixing it with other material so as to produce a fertilizer acceptable for American farming practice, a very important market would be opened for this product. Its efficacy is unquestioned. Throughout the continent of Europe it is used in great quantities with phosphates and potash salts by the beet root cultivators and other farmers. But in America a fertilizer that does not lend itself to mechanical feeding with perfect regularity of feed, so that a given number of pounds to the acre can be distributed, is at a great disadvantage in the market.

The formation of caliche, or nitrate, beds is attributed to the decomposition of animals and vegetables in contact with saline deposits left by the sea. In support of this opinion there is cited the frequent presence of birds' skeletons, shells, fish, guano, and the eggs of sea birds in the vicinity of the deposits of caliche, even at a depth of 10 or 15 feet under the surface, and also of iodine in the form of iodate of soda.

The richest deposits are situated upon the border of the Tamarugal pampa, in the province of Tarapaca. The depth of these varies between 6 inches and 12 feet, and they are covered with conglomerates or a crust of porphyry, and sometimes of gneiss and syenite. The Ramirez deposits cover an area of 2,600 acres. They skirt the pampa, and are situated 57 miles from the port of Iquique by rail, and 40 miles by direct mule road.

The crude product contains about 51 per cent of nitrate of soda, 26 per cent of common salt, 6 per cent of sulphate of soda, and 3 per cent of sulphate of magnesia. The remaining 14 per cent consists of earth and insoluble matter.

The caliche, coarsely broken *in situ* into 25 or 30 pound blocks, is carried by the trains to the stamping mills, which break it into pieces two inches square, whence they are sent to the dissolving boiler. The treatment consists in dissolving the caliche in the mother-water derived from preceding treatments, and allowing the solution to crystallize. There are twelve dissolving boilers, each heated by a steel worm of six spirals, in which circulates steam at four atmospheres produced in steel generators.

As soon as the solution marks 110° by the Twaddell densimeter, the steam is shut off, and things come to a standstill for a quarter of an hour, when the liquid is allowed to flow into a conduit, from whence, through secondary pipes, it reaches the crystallizing backs. Its temperature is then 115°. The residuum is washed with water, and the latter, which contains nearly all the remaining nitrate of soda, is sent to a special reservoir, from whence it is taken by a centrifugal pump and forced into the nearest dissolving boiler. When all the wash-water has been expelled, the boilers are opened and the residuum is thrown into the cars, which carry it to the dump heap.

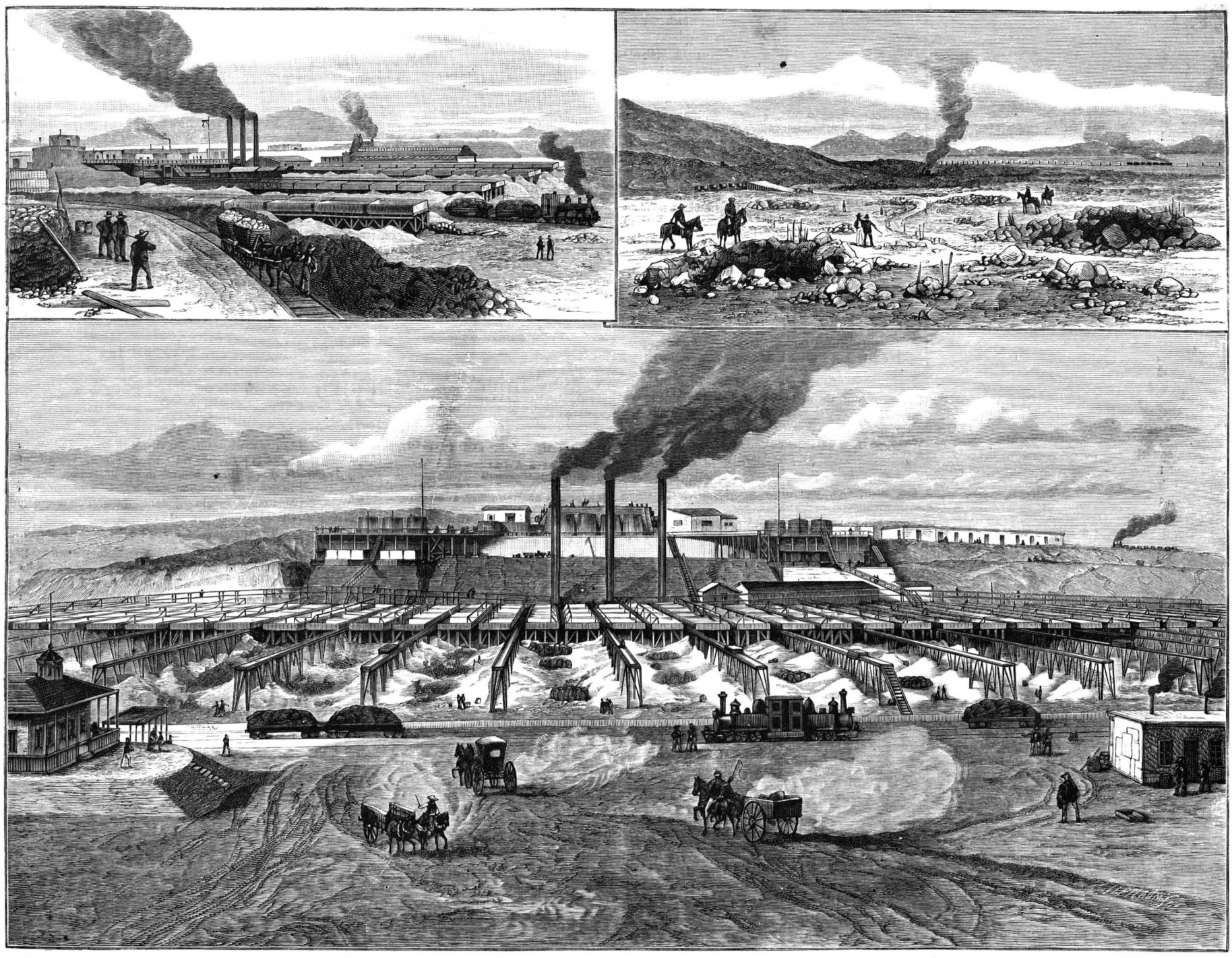
The crystallizers are ninety in number. They are 15¾ × 15¾ ft., and have a depth of 3 ft. at one side and of 2¾ at the other, so that the precipitate may be thoroughly drained. These backs are supported by a framework of Oregon pine. Under each of them there pass six joists, whose ends carry a platform which serves as a passageway for the workmen who attend to the precipitation.

After the cooling of the liquid and the crystallization, the *agua vieja*, or mother-water, is drawn off through a conduit which leads it to a cylindrical reservoir 24½ ft. in diameter and 12 ft. in height, placed on a level with the ground. From this it is pumped up for feeding the dissolving boilers. It generally marks 90° Twaddell.

The products of crystallization are afterward spread over a floor with shovels and allowed to dry in the sun. Then they are put into bags, in order to be sent to Iquique, the shipping port for Europe and the United States.

The residua still contain 3 per cent of nitrate, the greater part of which might be extracted by further washing; but this would perceptibly reduce the concentration of the mother-water, and the evaporation would thereafter become more costly.

The work goes on during the night. The grounds are illuminated by two 6,000 candle power arc lamps.



THE NITRATE OF SODA WORKS AND FIELDS OF CHILE.

Rapidity of Movements.

Science says a pianist, in playing a presto of Mendelssohn, played 5,595 notes in four minutes and three seconds. The striking of each of these notes, it has been estimated, involved two movements of the finger, and possibly more. Again, the movements of the wrists, elbows, and arms can scarcely be less than one movement for each note. As twenty-four notes were played each second, and each involves three movements, we would have seventy-two voluntary movements per second. Again, the place, the force, the time, and the duration of each of these movements was controlled. All these motor reactions were conditioned upon a knowledge of the position of each finger of each hand before it was moved, while moving it, as well as of the auditory effect in force and pitch, all of which involves at least equally rapid sensory transmissions. If we add to this the work of the memory in placing the notes in their proper position, as well as the fact that the performer at the same time participates in the emotions the selection describes, and feels the strength and weaknesses of the performance, we arrive at a truly bewildering network of afferent and efferent impulses, coursing along at inconceivably rapid rates. Such estimates show, too, that we are capable of doing many things at once. The mind is not a unit, but is composed of higher and lower centers, the available fund of attention being distributable among them.

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RECENTLY PATENTED INVENTIONS.

Engineering.

LOCOMOTIVE BOILER.—John Sharkey, Winnipeg, Manitoba, Canada. This boiler is made with return flues and a smoke box at each end, a cylindrical steam drum extending horizontally above the entire length of the boiler, the throttle valve being located in the top of the steam drum, centrally through which is a chimney flue, with other novel features, the object being to promote economy in the use of fuel.

Railway Appliances.

CAR COUPLING.—Charles W. Duncan, St. Louis, Mo. This coupling is constructed with two laterally-yielding headed coupling jaws, an arrow-headed coupling bar projecting between the jaws, and an uncoupling slide or bar adapted, when thrust forward, to separate the jaws for uncoupling, the device operating to couple cars automaticaliy, while the uncoupling may be effected without train men going between the cars.

CAR COUPLING.—Edward P. Eastwick, Jr., New York City. This invention relates to an improved coupler of the vertical plane type, and provides means for pivoting a removable knuckle in the drawhead in a novel manner, whereby large bearing surfaces will be obtained without greatly decreasing the strength of the knuckle, and also providing means for inserting and holding the tail bolt in the shank of the drawhead without removing the knuckle.

CAR ROOF.—Alfred P. Le Gros, Louisville, Ky. Combined with rabbeted roof boards in a car roof is a painted canvas folded and fitted into the rabbets, and a metallic cover fitting on the canvas, the invention being an improvement on a former patented invention of the same inventor, for a construction designed to facilitate the rapid draining of the car roof during heavy rain.

CAR STARTER. — Caleb T. Cleaveland, Kingston, N. Y. A ratchet is arranged for connection with the car axle, a pawl in a swinging frame engaging the ratchet, while cables or chains are connected to the frame, one of which is connected to a spring while the other is connected to a transverse draught lever, the parts being so arranged that the first pull of the horses will bear with increased effect on the forward axle of the car.

Mechanical.

INDEX FOR GEAR CUTTERS.—Michael Schirk, Plattsmouth, Neb. This is an indicator attachment designed to be applied to an ordinary slotting or gear-cutting machine, without material alteration of or injury to the machine, to show accurately the number of equal subdivisions into which the periphery of a disk is to be divided in cutting a gear wheel of any desired number of teeth.

AUTOMATIC KNIFE GRINDER.—Alfred E. Creigh, Ronceverte, West Va. This is a machine designed for use in planing mills, box factories, etc., automatically carrying the knife back and forth in contact with the grinding wheel, while the machine can be so adjusted that when the knife has been ground it will be automatically held from contact with the wheel, and the parts are so arranged that it will be impossible to draw the temper from the knife being ground.

Miscellaneous.

WEATHER STRIP.—Alexander L. Kirkpatrick, Orrick, Mo. This strip consists of a holder formed of a metal plate folded upon itself, forming inner and outer plates, their lower edges formed with flanges projecting toward each other, the plate or strip proper having its upper edge formed with a bead fitting in the holder, with a slot in the beaded edge, and a pin extending from the holder into the slot, making an effective weather strip which will not impede the opening or closing of the door.

LINIMENT. — Harriet E. Hoover, Lincoln, Neb. This liniment is designed as a remedy for sprains, burns, cuts, toothache, headache, and other pains or ailments, and is made of alcohol, oils of wintergreen, hemlock, sassafras, etc., compounded in proportions and after a manner described.

FAN FOR ROCKERS. — Hermann Wittmann, Rudolph, Wis. This is an attachment for rockers, cradles, swinging seats, etc., which may be readily and expeditiously secured in place without marring the furniture, whereby, as the chair is rocked backward and forward, a continuous lateral oscillating movement is imparted to the fan, a very slight rocking giving the fan an ordinarily sufficient movement.

ORGAN CASE. — Hiram E. Chute, Yarmouth, N. S., Canada. This is a casing with a fall board or key board cover which may be noiselessly opened by the depression of the pedals, the casing also furnishing means for the automatic closure of cracks around the pedals when the fall board is closed, whereby dust and vermin are excluded from the interior of the instrument.

PHOTOGRAPHIC CAMERA.—George S. Moler, Ithaca, N. Y. This is a camera more especially designed for instantaneous work, in which provision is made for storing and manipulating for exposure a series of dry plates, whereby a succession of photographs may be taken with great rapidity, and the plates used in irregular order if desired.

COMBINATION SCREEN. — Samuel Holdsworth, Brooklyn, N. Y. This is a screen made with pivotally connected arms and plates, the latter arranged for connection with a window casing, and guide or run ways engaged by eyes carried by the screen, the combination being such that the screen may be easily stowed, or it may, if desired, be used as an awning support.

ELECTRIC DOOR ALARM.—Edwin W. Taylor, Charlottetown, Prince Edward Island, Canada. This is an attachment for door locks and latches, by means of which an electric circuit will be completed when the lock or latch bolt is withdrawn, the improvement being also applicable for safes, an alarm or indicating apparatus being connected in the circuit with a battery.

CHECK PUNCH. — Samuel M. Levy, New York City. This is a device for punching into checks, drafts, etc., apertures representing numerals or figures indicating the face value of the instrument, there being a block with clamping plate to hold the paper in place, rows of lugs projecting from the edges of the plate, and punches, each having on one of its prongs a pin fitting between the lugs on the clamping plate.

DRAWING AND MEASURING INSTRUMENT.—William G. Curtis, Philadelphia, Pa. This is a combination instrument in which is included a rule, dividers, calipers, beam compasses, squares, etc., the rule being adapted to use as an ordinary rule in the usual manner, and the invention covering novel parts, details, and combinations.

RULING PEN. — Reinhold Handel, Leipsic, Saxony, Germany. This is an adjustable pen, more particularly designed for ruling the stave lines for writing music, its essential feature being that the distance between the several lines drawn by it can be readily varied and adjusted, its teeth or points being all connected with a slide, by moving which the distance between the separate pens is regulated.

JEWELER'S VISE.—William G. Sheppard, McCook, Neb. Each jaw of this vise is made with a horizontal recess, a seat plate fitting in the recess of one jaw with a spring behind its inner end, its tension regulated by a threaded rod and nut, the vise being designed to prevent injury to delicate work which might be injured by being clamped too tightly by the jaws.

WAD PULLER. — Myron A. Twitchell, Moville, Iowa. This is a device in which a plunger is movably held in a body portion, the plunger having at its inner or lower end a laterally operating gripper, intended for use in removing wads from shells when it is desired to remove the load.

SCIENTIFIC AMERICAN
BUILDING EDITION.

DECEMBER NUMBER.—(No. 50.)

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1. Elegant plate in colors of a cottage for $1,000. Perspective elevation, floor plans and details.
2. Plate in colors of $1,500 cottage. Floor plans, perspective elevation and details.
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4. Colored plate of the residence of E. Bridgeman, Esq., Staten Island, N. Y. Cost about $18,000. Floor plans, elevations, etc. E. A. Sargeant, architect.
5. A cottage erected at Larchmont Manor, N. Y., at a cost of $1,500 complete. Perspective elevation and floor plans.
6. The new Bourse or Commercial Exchange at Paris, designed by M. Berteault; interior and exterior views. Cost $1,400,000.
7. A cottage recently erected at Larchmont Manor, N. Y., at a cost of $3,000. Floor plans and perspective. Architect W. Holman Smith, New York.
8. Cottage at Larchmont Manor, N. Y., erected at a cost of $4,500 complete. Floor plans and perspective. Architect Henry Kilburn, New York.
9. A very attractive cottage at Iselin Park, New Rochelle, N. Y., at a cost of $3,400 complete. Plans and perspective.
10. Residence at Holyoke, Mass. Cost $5,500 complete. Perspective elevation and floor plans.
11. Engraving and ground plan of a church at Rutherford, N. J.
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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1640) J. B. G. writes: We have a well 65 feet deep, the water rises 7 feet above the surface. Water analyzed with the following result, parts per 100,000: Oxygen required 0·11, free ammonia 0·010, albumenoid ammonia 0·005, nitrous acid trace, chlorine 2·21, total solids 38·2. 1. Would this be regarded as good water for public supply? A. It is apparently an excellent water. The chlorine is perhaps a little high. 2. Is it what is called hard or soft? A. The analysis does not disclose this. It cannot be seriously hard. 3. Please reduce it to grains per gallon. A. Multiply by the decimal 0·58333 to effect the desired reduction.

(1641) W. H. L. asks: 1. Where, on what kind of bottom, black bass are to be found. A. Black bass are found on all bottoms, but the rocky bottom is probably the best. 2. Is a muscalonge an overgrown pickerel? A. The muscalonge is a distinct species.

(1642) W. W. P. asks: What books would be of benefit to me? I am a pattern maker. A. We can mail "Pattern Making" by a foreman pattern maker, 379 illustrations, $3.

(1643) W. B. asks (1) Where to obtain ebonite used on the reel of an induction coil. A. From any dealer in electrical supplies. 2. How can I make any desired form of it I want? Can I mould it like lead? A. By turning, sawing, and filing. It cannot be melted and cast. 3. Where can I get cartridge paper? A. Use any thin, strong paper. 4. Does it make any difference how the wire is wound on the reel of an induction coil, whether it is from west to east, or east to west? A. No. 5. Is double insulated wire better to use than single insulated wire? A. Use good quality single insulated, relying on the shellac, etc., to perfect the insulating. 6. A firm who deal in Geissler tubes. A. Consult our advertising columns for dealers in scientific apparatus.

(1644) A. G. U. asks: What is the velocity given a solid body three feet long, weighing fifty pounds, in a 10 inch tube, fitting as neatly as a piston fits in a cylinder, by compressed air, at any given pressure you may select, that is, if the air follows the body, forcing it forward, what distance will the body travel before requiring a new supply of air to continue the body at the highest speed? What will be the friction to be overcome, and what is the most economical pressure of air and weight of body to use? What material should be used for best results? What do you know from actual practice here and abroad—Paris, for instance—on the subject? What effect do curves have upon it? A. We have no practical example of a heavy body as a piston moving in a long tube at high velocities. The pneumatic gun is a successful example of a heavy shell projected by an impulse of compressed air for a short distance, a full description of which may be found in back numbers of SCIENTIFIC AMERICAN SUPPLEMENT. In a long tube a given volume of compressed air would only follow the moving body with decreasing pressure for the distance due to the amount of compression. The pressure of air must be constant behind the piston or shell within a pneumatic tube in order to keep up the speed or velocity for any considerable distance, and also greater than the friction of the piston on the tube as well as friction of the air upon the sides of the tube, and to supply windage or leakage. The moving piston should be as light as possible and of a nature to cause as little friction as possible, for friction generates heat, and the piston in a long pneumatic tube might accumulate heat enough to injure it or its contents. Pneumatic tubes in use in New York have curves on a radius of 20 to 30 times their diameter, with pistons about three times as long as wide; with these proportions the pistons run freely. They are made of thin steel covered with leather. See SCIENTIFIC AMERICAN, October 19, 1889, for illustrated description of the Johnson pneumatic tube with a rolling ball.

(1645) O. B. J. asks (1) how to split paper. A. Paste the paper between two sheets of very firm paper. When the exterior is quite dry, pull the two sheets apart, and one-half will adhere to each sheet. The points are to have the outer sheets stronger and firmer than the one to be split, and to have the latter nearly but not absolutely dry. The best flour paste works very well. If mucilage be used, it may penetrate the paper, when it will prevent splitting. It can also be sometimes done by soaking the paper and laying it on a plate of glass, and by careful manipulation dividing it. 2. A medium by which paper can be made transparent. A. Castor oil. 3. What to use to mount transparent paper on glass, so that it will retain its transparency? A. Mount with flour paste, and when perfectly dry saturate with castor oil. Dammar varnish or Canada balsam may be used to mount and render transparent in one operation. Or the paper may be wet, attached to the previously varnished glass, which has been allowed to dry until tacky, and when perfectly dry can be thinned by rubbing with the wet finger. A final varnishing completes the operation.

(1646) W. V. E. writes: I have seen what looked like plain glass, but by breathing on it you could see a picture. What was used to produce this? A. The design is very lightly etched upon the glass with hydrofluoric acid. Fluor spar moistened with sulphuric acid can be used. The process is described in our SUPPLEMENT, No. 378. 2. I want a receipt for bird lime. A. The middle bark of the holly is boiled for seven or eight hours in water, is drained, placed in heaps, and allowed to stay for two or three weeks until decomposed into a species of mucilage. It is then beaten in a mortar, kneaded with water, and allowed to stand in stone jars for four or five days. An inferior kind is made by boiling down linseed oil until thick. In the latter operation there is danger of sudden combustion; it should be done out of doors, and the pot should be kept covered.

(1647) A. T. writes: 1. How can I make axle grease out of resin oil and lime, such as Frazer axle grease? A. Dissolve ½ pound caustic soda in 1 gallon water, add 3 pounds tallow and 6 pounds resin oil or 10 pounds oil alone. Heat to 210° Fah., stir and mix as it cools. 2. Can I feed hogs with oil cake from castor beans pressed in an hydraulic press? A. We should not recommend it. 3. I send you a sample of earth found in the neighborhood of this city; please state of what it is composed, and how I can bleach it snow white in order to fill soaps with it? A. Only by treatment with acid, which will probably make it too expensive. It contains silica, alumina and oxide of iron. 4. Has it any value as color? A. No. Possibly it might be of value for brick or terra cotta.

(1648) K. G. asks (1) if meats disinfected by chlorine or chloride of lime putrefy afterward. A. They may, if the chlorine escapes completely. 2. Would the chloride of lime prevent their use? A. It would. 3. Is Labarraque's liquor equal to chlorine as a disinfectant? A. It is about the same thing as regards efficiency. One being a gas and the other a liquid, a direct comparison is not easy. 4. Is Javelle water the same as Labarraque liquor? A. Javelle water is the same as the other, except that it contains less soda and more chlorine. 5. Which of them has the least odor? A. Javelle water freshly prepared would have the greatest odor.

(1649) L. C. asks: 1. Have you ever described a motor of one or two horse power? If so, in what number? A. No. 2. Could the eight light dynamo described in No. 600, SCIENTIFIC AMERICAN SUPPLEMENT, be used as a motor? A. Yes. 3. If so, should any changes be made? A. No. 4. About what power would the eight light dynamo develop used as a motor? A. About 1 horse power. 5. What power would the eight light dynamo develop used as a motor increased to twice the size of the one described in No. 600? A. If twice the size linear, it would be about 5 horse power. 6. What power would this motor develop if the field magnets only are increased to twice the size? A. This would give an undesirable proportion, with no advantages.

(1650) B. B. asks: In the event of lightning striking an iron roof to a building, what would the effect probably be? Would the force of the electric current be dissipated by diffusion over a large surface, or would it demolish the roof? If the latter, what precautions ought to be taken to avert disastrous consequences? A. A metallic roof is an element of safety. If there are no rods, the lightning seems to divide and make its way by several paths to the ground. To prevent disaster, the roof should be connected by several rods to earth. The rods should be well grounded.

(1651) W. B. G. asks: What is the best instrument for the drawing of an ellipse, and where can it be obtained? A. For drawing ellipses trammels may be used. They are sold by dealers in drawing materials. Ellipses can be drawn by the use of a thread and two pins. The pins are driven into the foci of the curve, the thread is tied loosely around them, and a pencil placed against the thread and straining it outward if moved around, will describe the desired curve.

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(1652) J. G. asks how to make artificial ivory. A. Many processes have been used. One simple though not the most effective method consists in mixing powdered barytes with solution of white gelatine to a paste and compressing it into moulds. The above may be soaked in strong alum water with advantage.

(1653) M. L. writes: Can you recommend any method of finishing water color with a gloss? What I wish is enamel finish. A. Try varnishing with dammar varnish or Canada balsam. Good results may be obtained by cementing the picture closely against a sheet of transparent celluloid film.

(1654) S. G. asks if a current of the Edison electric light can be used for brass or copper plating of small objects of about 5 by 10 inches square. A. The current has too high a potential. This you can reduce by inserting resistance before or after your bath, equal in amount to about twenty times that of the bath.

(1655) Subscriber.—For electric wiring of buildings from a practical standpoint we recommend "Incandescent Wiring Hand Book," by Badt, $1, and also our SUPPLEMENT, Nos. 603 and 699, which we can supply for 10 cents each.

(1656) P. O. D. asks: On what does the strength of current in a thermo-electric series depend? A. On the nature of the substances composing the couples, on their number and order, and on the difference of heat at opposite extremities. Experiments only can determine the relative thermo-electric potential of different combinations.

(1657) C. W. writes: Will you inform a reader how to remove raw linseed oil from a fine quality of brown stone, such as is used for steps? A. Our best advice is to oil the steps all over with the same oil. You cannot remove it without leaving a stain.

(1658) J. W. L. says: Please inform me how the calibers of shot guns are numbered and what part of an inch do the Nos. 8, 10, 12, 14, 16, 18 and 20 represent. I wish to make some gun tools and have not the desired information. A. No. 8 "/85 diameter, No. 9 "/81, No. 10 "/79, No. 12 "/75, No. 14 "/72, No. 16 "/69, No. 18 "/66, No. 20 "/63, No. 22 "/ 62, No. 24 "/61.

(1659) E. R. asks for the simplest and most effective method of affixing connection on carbon polo of Leclanche battery, to prevent the creeping up of the salts and the consequent corrosion. The carbons I use are electric light pencils, and cannot very well be drilled through. A. Heat one end of each rod, and fill its pores for about an inch with paraffin. Cast lead around the paraffined ends of the rods.

(1660) D. E. W. asks: 1. What can I paint the coils of the field magnet and armature of simple electric motor with, so as to have them a bright red color? A. Use shellac with a suitable pigment, English or Chinese vermilion. 2. I used tinned iron wire for my armature ring. Will it work as well as if it were bare? A. Yes. 3. How large a candle power incandescent lamp is equal to a common kerosene light? A. 8 candle. 4. Would the battery you describe to run the motor run such a light? A. Yes. 5. How many cells, consisting of two carbon plates 5×7 and one zinc 5×7, would it take to make the motor turn? A. One or two cells will make it turn. 6. Could I charge a one gallon storage battery through the day with two "disque" Leclanche cells to run a 4 or 6 candle power lamp an hour or so in the evening? How should I connect it if I could? A. The Leclanche cell is not adapted to this use. 7. What do the pocket batteries which are used to run the small incandescent scarf pins consist of? What solution is used for charging? A. Carbon and zinc plates and a bichromate solution. 8. Can I produce light, by a battery, between two carbon points ¼ inch in diameter or smaller? How large a battery will I need? A. Yes, 50 to 60 cells of Bunsen or Grove. 9. I have a number of carbons which have been used in a Leclanche "prism" battery until the battery refused to work. Now, will these carbons work nearly as well (as new ones) in a bichromate battery? A. They would work very well.

(1661) W. S. V. B. asks for a formula for making dry plate lantern slides. A. Use the Eastman or Carbutt transparency dry plate, 3¼×4, expose in contact with the negative, three seconds, about two feet distant from a gas burner. Develop the image with following developer:

Water	1½ oz.
Sulphite soda	50 grs.
Eikonogen	4 grs.
Carbonate of potash	3 grs.

After development wash and fix in hyposulphite soda 20 grains, water 1 ounce. Wash for 20 minutes in changing water, then dry. For projecting the slides on a screen use a ¼ Darlot portrait lens and a 4 inch condenser. The requisite lantern may be had from manufacturers of optical goods, such as Queen & Co., Philadelphia, Pa.

(1662) Z. W. asks (1) how to get a good polish on mahogany easily. A. Mix one part of boiled linseed oil with two parts of alcoholic shellac varnish. Shake well before using. Apply in small quantities, with a cloth, and rub the work vigorously until the desired polish is secured. 2. I am making a mantel ornament; what shall I place between the woodwork and the chimney, to prevent the heat from doing injury? A. A piece of polished sheet metal. 3. How to rid a flower pot containing a century plant from ants, which has been standing in the yard all summer? A. Try filling the earth in the pot with tobacco smoke. It is said that leaves of green wormwood scattered about will disperse ants.

(1663) D. B. H. says: The creek touching our house during heavy rains gets very high and wild. When the water reaches a certain height (from 5 to 8 feet above low water line), the wells in the vicinity of 850 to 1,800 feet get very cloudy, water tasting slightly of iron properties, yet after these incessant rains the wells (among them an artesian well) have become perfectly clear and water has a fresh taste. What is the cause? A. The cloudiness in the well water at times of severe rains is no doubt caused by surface leakage, either by soakage through the top soil near the well or by direct drainage into the wells. The carelessness in regard to well surroundings all over the country is remarked by many observers having experience in these matters. The same condition as to surface infiltration into pumping artesian wells is also observable. Water entering wells through the proper channel is filtered in all seasons alike, and should never be cloudy or muddy. Too often the spill of a pump is allowed to form a mud puddle around the well, which leaches the poison-breeding water back into the well—sources of fever and disease.

(1664) A Reader asks (1) for the process of silvering glass. I have a small galvanometer mirror from which the back has worn off, and I desire to replace it. A. Place a drop of mercury on the back of a small piece of looking glass, and the coating will become so loosened that you can push it off over the edge and catch it upon the back of your galvanometer mirror. Or you can silver it thus: Form a rim of beeswax around the edge, and pour upon it a solution of nitrate of silver containing a slight excess of ammonia, or a little more than enough to dissolve the brown oxide first formed by its addition. Ten grains of nitrate of silver to one ounce water is sufficient. To this add as it lies upon the glass half as much of a solution of the same strength of Rochelle salts in water. It should then be warmed to 70° or 80° Fah. by being placed near a fire or in the sun. 2. The recipe for making draughtsman's black and red liquid ink. A. For black, grind up India ink in a strong solution of borax. For red, dissolve 1 drachm carmine in ½ drachm liquor ammonia 0·880 sp. gr. Dissolve 20 grains gum arabic in 3 ounces of water, and mix the two solutions.

(1665) S. L. H. asks: 1. What is the specific gravity of the oil of juniper? A. 0·850 to 0·880 at 59° Fah. 2. What is its boiling point? A. 302° to 359° Fah. 3. Where is the paper called *Chemical News* published? A. London, England. 4. Where is dynamite manufactured? A. In the United States and in Europe in a number of places. 5. What book has been published on essential oils and their manufacture? A. We recommend Brandt on "Animal and Vegetable Fats and Oils," which we can supply for $7.50. 6. Is there any book published upon the manipulating of glass tubes and glassware, for the amateur? A. We recommend Shenstone's "Methods of Glassblowing for Amateurs," which we can supply for 80 cents. 7. Give a recipe for making an ink which will fade in say twenty-four hours, and a chemical which will bring it back again. A. Write with nitrate of silver and a quill pen. Restore by exposure to hydrosulphuric acid vapor.

NEW BOOKS AND PUBLICATIONS.

REPORTS ON THE OBSERVATIONS OF THE TOTAL ECLIPSE OF THE SUN OF JANUARY 1, 1889. Sacramento. 1889. Pp. xx, 210.

The title of this book sufficiently designates its contents. It gives the work done in observing the total eclipse of the sun in California, not in only at the Lick Observatory, but by independent observers all over the State as well. It is published by the authority of the leading university of California, and forms a most important and valuable addition to the Lick Observatory publications. The photograph given as frontispiece showing the corona during total eclipse is a gem in its way.

LA LUMIÈRE ELECTRIQUE. By L. Montillot, director of military telegraph. Paris: J. & B. Bailllire et Fils. Pp. 408.

The subject of generators, lamps, distribution and application of electric light, are given in great detail in this volume, which is very profusely illustrated. The practical portions relating to machines on shipboard and in theaters are especially entertaining for the general reader, while its numerous *resumes* of all the changes that have been introduced in the science and of all the applications, with its numerous illustrations, make it of value to all.

ALTERNATE CURRENT MACHINERY. By Gisbert Kapp, A.M.I.C.E. New York: D. Van Nostrand Company. Pp. 199. Price 50 cents.

This addition to the well known Van Nostrand series, because of the present interest in the subject and the eminence of its author, may be said to have an especial value. It is illustrated where required.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

December 10, 1889,

AND EACH BEARING THAT DATE.

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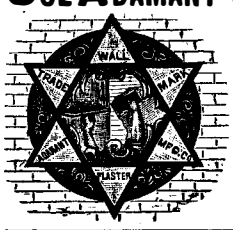

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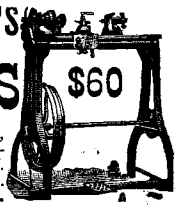

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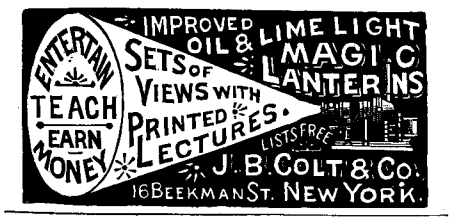

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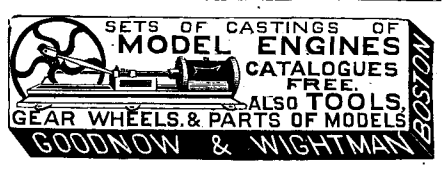

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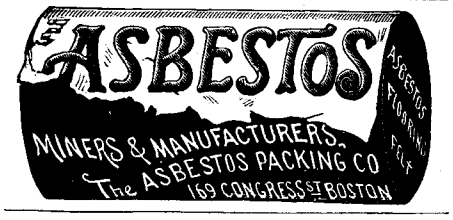

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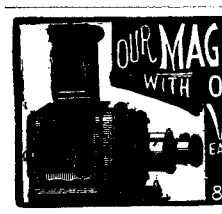

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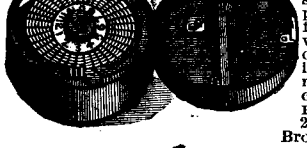

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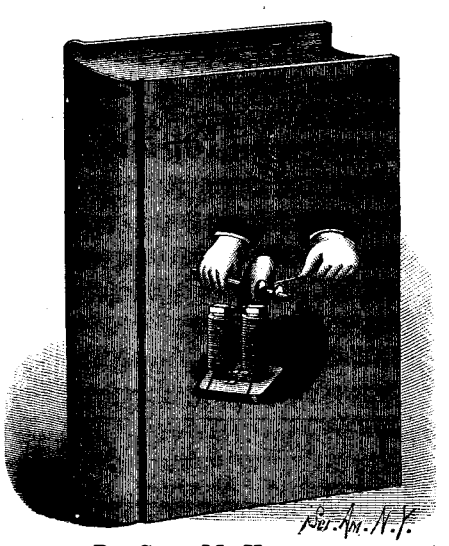

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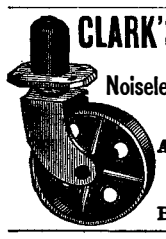

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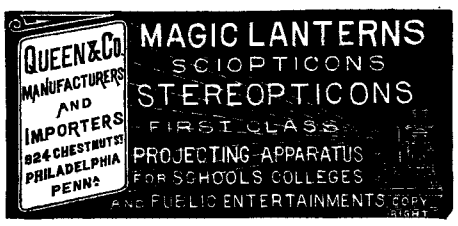

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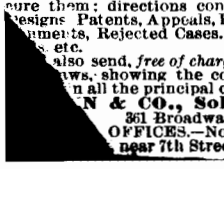

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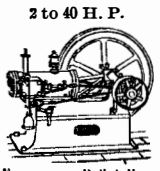

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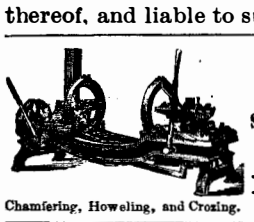

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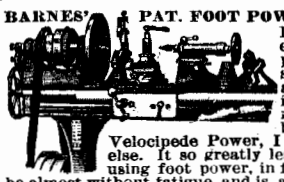

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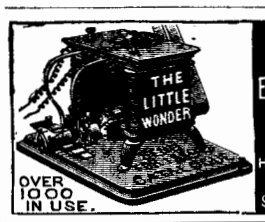

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